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Regulation of Securities

The one dominant feature which appears in most of the messages of governors to the state legislatures is the insistence with which laws placing the promotion of corporations under public regulation are asked for. Ever since creation human nature has been endowed with a desire to amass fortune quickly and without labor, and all the swindling transactions that have gone on for years have prospered because of the gullibility of unsuspecting and inexperienced investors whose hard-earned cash has been exchanged for beautifully lithographed stock certificates worth oftentimes less than the cost of printing them. In those states possessing public service commissions having authority to supervise the issuance of stocks, bonds, etc., the government already exercises control and the utilities have no difficulty in disposing of securities thus vouched for. Reputable bankers throughout the country are offering such stocks and bonds to their patrons as safe investments, which also have the added advantage of paying an excellent return. In this respect, aside entirely from the power of the commissions to fix and regulate rates, the public service commission laws have been a boon to central-station companies, many of which have heretofore had to depend on the whims of local financiers for money with which to make extensions, etc. With the securities of other corporations placed under like regulation, a salutary influence should pervade the investment market.

The Falling Copper Market

Falling prices in a freely competitive market indicate decreasing demand, increasing supply, or possibly both. When competition is limited or circumscribed, and prices accordingly are under the control of a comparatively small group of producers, price cutting is indicative as a rule of a falling off in business. This is the conclusion which seems justified by the recent drop of nearly a cent a pound in copper. The converse building up of prices under rising demands is usually a slow process, and the rise almost invariably continues until business is checked. Then comes a slump, which ordinarily takes place rather precipitously, because bona-fide buyers are proverbially conservative in a falling market, waiting until the bottom level is apparently struck. That a 19-cent base price for copper wire was unwarrantably high, all things considered, seems entirely evident, and therefore the drop comes as a relief. In the characteristic American eagerness to "whoop things up," regardless of whether the activity is fundamentally justified, is found one of the underlying causes of our typical cyclic variations in commodity prices. Perhaps the day is coming when we shall have a simpler or clearer index of prosperity as a whole, which will tend to suppress undue zeal in booming business at a rate not warranted by fundamental conditions.

The New York Commissions

Leaving aside for the time being the question of whether the two Public Service Commissions in New York State ought, on the abstract merits of the case, to be consolidated, it seems entirely premature to take up now the matter of such consolidation. The commission for the First District is in the midst of a great piece of transportation engineering in connection with the new dual system for serving the people of Greater New York, and it should be left undisturbed to complete the gigantic task which it has already started. Disquieting rumors have been abroad for some weeks past, particularly in reference to the personnel of the commissions and the filling of vacancies which expiring terms of service will soon create. Governor Sulzer clearly has a chance to inspire public confidence in the new administration, and incidentally add to his own laurels, by his course in these matters which so closely affect the welfare of both the utility corporations and the people at large.

One Way to Educate the Public

Even the small central station can follow with profit some plan like that now being carried out by the Edison Electric Illuminating Company of Boston, which offers gratis to local organizations the services of lecturers on electrical subjects. The Boston company's bureau was formed in response to the many requests for speakers received from local social, educational and religious bodies. Noting this, the management promptly showed its foresight by turning such a spontaneous demand into means for getting valuable publicity, charging the moderate expenses of the lecture service to advertising account. The results have been most gratifying, and a number of evening addresses have already been given in various parts of the great metropolitan and suburban district served by the company. As the central station's offer becomes better known locally, it is expected that the bureau's usefulness will grow still greater. In smaller places the central-station manager will find equal opportunities to reach his constituents in a way that will be both educational and profitable. For the metropolitan company's staff of special lecturers he will, of course, have to substitute his own services or those of his commercial agent—if he has one. In either case there will be accomplished valuable missionary work in explaining some of the possibilities and problems of electric service to present and prospective consumers. To most of the population in the small town "the electric-light man" is a being of mystery, leagued with occult forces and measuring and merchandising an imponderable and somewhat suspicious commodity. In the course of an evening's friendly talk, however, the central-station man can explain something about the uses of the vague utility which courses over his wires.

telling how it is made in the power plant and suggesting new electrical applications for the home, the shop and the office.

A few simple experiments will go far toward dispelling much of the mystery of the central-station business, and opportunity should be given to have the questions of the public answered clearly and sufficiently. An exhibit of appliances and devices will help round out the domestic interest of the evening. Several of the large manufacturing companies also stand ready to loan moving-picture films in which demonstrations of apparatus are woven into attractive little household dramas. One central-station manager made his bow on the local rostrum by appearing semiannually before the physics class at the high school. His talks proved so interesting that later he was asked to address the whole school. Meanwhile the young folks were taking home the ideas imparted, and already a direct influence was being felt by the local service in the demand for new appliances and improved lighting facilities, and even in a better understanding of the company's aims. Quick to learn, the physics pupils found they could read the meters in their own homes and those of neighbors, instilling both pride and confidence when the bills rendered later agreed with the amateur estimates. Soon the older people of the community began to request the central-station man to give some of his interesting talks at their church socials, literary societies, club meetings, etc., and now his name is a household word among the townspeople. It has taken a good deal of the manager's time and effort to be ready with an entertaining topic on each occasion, but in making this outlay he has built up a property of almost inestimable value in the friendly sympathy and understanding which the local public now has for his company's service.

Energy for Railroad Electrification

One of the most hopeful signs pointing to railway electrification is the disposition to purchase energy for such purposes from transmission systems in existence or to be established, or even from central stations large enough to carry the load economically. If one runs back over the history of proposed railway electrification, it is unhappily self-evident that extremely little progress has been made toward the larger work, save for the substitution of electric motive power for steam on a few roads which had they been originally built a few years later than they were would have been electric from the first, and for the electrification of some tunnels and terminals practically under duress. The adoption of electric motive power in standard railway work has been confined to one or two instances, thus far of small magnitude. Upon analysis the causes which lie back of this record of apparent apathy will be found to be chiefly matters of finance entirely independent of any engineering phases of the problem. It is frankly admitted on all hands at the present time that electric traction on a large scale can be made a success and can be of great practical benefit to the roads concerned. It is well known, for example, that the electric locomotive is if anything more reliable than the steam locomotive, requiring fewer repairs and less attention. It is able to run with safety more miles between inspections and can haul heavier loads at better speeds for the same strain on the track. Generally, too, the electric locomotive is a more powerful and reliable machine than even the best steam engine. It is equally true that the problem of distribution of electrical energy for a general trunk-line service has been pretty well cleared up and that there is no reason to hesitate about electrification on this account.

On the other hand, it is a well-nigh universal experience that railway men deep in the matters of practical management almost invariably shy at the idea of electric traction. On questioning one with this doubting mind it is generally found that the real reason for a lack of interest is the fact that his road cannot stand the expense of the change. Of course, it is known too well to need comment that most American railroads have been, first and last, very heavily capitalized, and that in pursuing the reckless policy of buying up competitors at any price many large systems have put themselves on the very last limit of their possible borrowing capacity. In short, few roads, even were they disposed to go into electric traction as a matter of obvious economy, are in a position to float the necessary securities on good terms. The present tendency toward the supply of energy for railway purposes from big transmission plants or central stations opens a way of relief which should have a very important influence on the extension of electric traction. The arrangements recently made by the St. Paul transcontinental line to electrify more than 400 miles of road, using energy to be purchased from the Great Falls Power Company of Montana, is a case in point. In this instance the great advantage of the electric locomotive for heavy-grade work will tell immensely in its favor, but, aside from this, the fact that the change can be made without compelling the road to assume the additional burden of generating the energy is a significant one. It means that the power development can be taken up and financed on its merits, with an insured market furnished by the railroad, while the railroad can go ahead with its electrification unhampered by the necessity of a heavy permanent investment in a power plant which it could not utilize to the best advantage solely on its own line.

There is no logical reason why a railroad desiring to use electrical energy should have to begin at the beginning and build a costly special plant for its service, any more than there is reason why, desiring coal, it should go to great trouble and expense in acquiring and developing coal mines. It can buy electrical energy in one case and coal in the other in many instances cheaper than it can possibly generate or mine. The great technical difficulty about a station supplying energy to a large railway electrification is that the load-factor is likely to be peculiarly bad. The railway load, with its sudden peaks and low average, can be handled much more economically in a station already carrying a huge miscellaneous output in which the relatively minor variations of the railway service sink and disappear. The gain in the matter of load-factor in a station operating both railway and miscellaneous load is enough in most cases to determine the economies of the question. Moreover, the railway load, when distributed over a considerable system, is a comparatively easy one to

handle because it has as a whole no large general peak, except in the case of purely suburban service. In any event it adds much more to the general load on the station than it does to the peak load as such, so that the net result is an improvement in the load-factor. Moreover, the diversity-factor of a large railway system is an advantageous one, so that the aggregate demand of the system for power is not excessive. For these reasons, and for the added one that a great plant operated either by water-power or by steam is able to generate energy very cheaply, a road desiring electrification should, if in a favorable locality, be able to buy energy at an advantageous figure without becoming involved in the expense incident to generation.

All through the Rocky Mountain country there is ample water-power for the electrification of all the transcontinental railroads without exceeding transmission distances now regarded as fairly conservative. As one draws into the Middle West water-powers are, to be sure, less plentiful but cheap coal takes their place and electrical energy can be and is produced in the great plants of that region at an astonishingly low figure. There is every reason, therefore, why a railroad interested in electrification should take up the task unburdened by the power-station end of the proposition. Freed from this, it should be able to undertake the organization of its distribution system and operating elements with more freedom than would otherwise be the case. We look to see extensive advances made in railroad electrification within the next decade. The great Western work to which reference has just been made is promised for completion within the next three years, and once the advantages of electrification are shown on so great a scale it is safe to say that the example will be followed in numerous other instances. The removal of the complexities of station organization and management, and the very large added first cost due thereto, will make the task of arranging electrification very much more simple than has heretofore been the case. These foregoing facts, as we have pointed out, should lead to very cheap energy supply, since the large transmission systems or central stations generate the necessary output for the railroad under more favorable load conditions than would be possible were the road operating its own power plant.

Long-Distance Radio-Telegraphy

Long-distance radio signaling has passed out of the stage where a designer when he wished to rate an instrument merely "thought of a number" and wrote it down. With the establishing of reliable data relating to transmitter power delivery, signal intensity, distance and character of country separating the sender and the receiver, this branch has become a matter of engineering very nearly as exact as any other division of electrical science. The adoption of uniformly operating methods of generation and more rugged receivers—which are of surprising sensitiveness—together with high-musical sparks for penetration of atmospheric disturbances, has made long-distance wireless telegraphy fit for management on businesslike principles. The consistent work of the Marconi transatlantic stations at Glace Bay, Nova Scotia, and Clifden, Ireland; the proposed series of British government plants linking the world, and the several transatlantic stations now in course of erection within a few hundred miles of New York, all join to indicate clearly that the dream of ten years ago is the fact of to-day. By the use of transmitters generating sustained streams of waves, working in connection with very delicate yet very stable receivers, and operating at the high speeds of automatic telegraphy, a new era of commercial radio communication seems likely to break upon us at any moment. With perhaps the assistance of multiplexing, the inherent economy of radio transmission due to its absence of investment in line wire or cable plant seems likely to make it a formidable rival of the older and more familiar methods of electrical transmission of intelligence.

A detailed description of the high-powered naval radio-telegraph plant recently completed at Fort Myer, near Arlington, Va., is given in an article by Messrs. D. H. Tuck and M. B. Hodgson, appearing in this issue. This station is the first very powerful government wireless equipment to be placed in service in the United States. Somewhat over two years ago the federal wireless officers directed their plans toward an extended chain of powerful radio-telegraph stations which would ultimately connect United States possessions throughout the Atlantic and Pacific and thus allow communication independent of cables or wire telegraphs. It was felt that a first step should be toward securing facilities for transmitting orders from Washington directly to naval vessels stationed within several thousand miles of that point. With this in view an investigation of available wireless apparatus was made, and thereafter a contract was awarded for the equipment with Fessenden instruments of a coastal station and two scout cruisers, the *Birmingham* and the *Salem*. The shore station was guaranteed capable of transmitting to the ships, by day or night, from an antenna 600 ft. high, over distances up to 3000 miles; while the ship outfits were to be able to reply over any space not greater than 1000 miles.

For preliminary trials the shore-station apparatus was installed at Brant Rock, Mass., where a 420-ft. tower was available. Early in 1910 the cruisers were sent to sea, the *Birmingham* crossing to Liberia and the *Salem* traveling southward. Communication was maintained for a number of days, the signals from shore becoming uncertain at a little over 2000 miles. The test was adjudged successful, nevertheless, from a consideration of the lower aerial height and reduced power imposed by the location selected for trial, and consequently the erection of the Arlington station was commenced. Delays through strikes held back the tower construction and the plant did not reach completion until a few months ago. The 100-kw transmitter was removed from Brant Rock and reinstalled, and a series of tests were begun, with the result that Arlington's piercing high-pitched whistling spark has already been heard in Nova Scotia, in the Canal Zone and on the Northern Pacific coast. A final test is to be made next month, in which the cruiser *Salem* is expected to receive from Arlington over more than 3000 miles, and upon its completion our government will be in possession of the first link in the group of installations, which are expected to be models of efficiency and certainty in operation.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Wisconsin Electrical Association Meeting

(*By Telegraph*)

The opening meeting of the fifth annual convention of the Wisconsin Electrical Association was held in Milwaukee on the morning of Jan. 15. A brief address was delivered by President Irving P. Lord, of Waupaca. A report submitted by the committee on taxation was discussed to some extent. Interest in this important subject is particularly keen at this time owing to the new income-tax law. A paper on the maintenance of arc lamps was read by Mr. L. H. Lathrop, of Menomonie.

The greater part of the morning session was devoted to the reading and discussion of a paper on "The Proposed Revision of the Standards of Electric Service Which Is Now Under Consideration by the Railroad Commission of Wisconsin," by Mr. J. N. Cadby, of the engineering staff of the commission. Mr. F. A. Vaughn, of Milwaukee, discussed the tentative rules of the commission relating to electric service. It was announced that a public hearing on the subject would be held at Madison next month. The Railroad Commission seeks the co-operation of the central-station men and had an exhibit at the convention. Several manufacturers and jobbers also made exhibits.

Officers of Society for Electrical Development

A meeting of the Society for Electrical Development, Inc., was held on Jan. 14, 1913, at the Engineering Societies Building, New York City. At this meeting the work done by the organization committee was approved, as were also the by-laws of the society.

Immediately after the meeting of the society a further meeting was held of the board of directors, who were selected by the associations which they represent from the various branches of the industry. The complete board is as follows: Messrs. Henry L. Doherty, W. E. Robertson, A. C. Einstein, W. W. Low, J. E. Montague, Gerard Swope, W. H. Johnson, F. S. Price, J. F. Gilchrist, Roger Scudder, A. W. Burchard, Ernest Freeman, L. A. Osborne, E. McCleary, J. R. Crouse, P. N. Thorpe, B. M. Downs, J. R. Strong, W. A. Lyman and G. M. Sanborn.

The funds which have been advanced by the organization committee to carry out the organization work of the society were turned over, with all records of meetings of the organization committee, to the society, and officers of the society were elected as follows: President, Mr. Henry L. Doherty; vice-presidents, Messrs Ernest Freeman, A. W. Burchard, W. H. Johnson, J. R. Crouse and W. E. Robertson. The above, with Messrs. L. A. Osborne, Gerard Swope and J. R. Strong, compose the executive committee, on which will lie the heavier responsibilities of the further organization work of the society.

Appointments were also made of Mr. J. M. Wakeman as general manager and Mr. Philip S. Dodd as secretary-treasurer. Both Mr. Wakeman and Mr. Dodd are well known in the electrical industry and have a very intimate acquaintance with publicity problems of the kind involved in the present propaganda on behalf of electrical development.

The work of the society will be devoted to various lines of effort for the greater development of the electrical industry at large, and will be carried out along broad-gage lines aiming to increase in every way the uses of electricity, especially for lighting, heating and motor service.

It is a recognized fact that the time has come when it is not only possible, but practical, for the four different interested branches of the industry to co-operate in developing the entire business for the benefit of each and all. No one manufacturer, jobber, contractor, dealer or central station can carry out singly efficient educational work so well as it can be carried out by co-operative effort.

In the plans of Mr. J. Robert Crouse in 1905 to organize a Co-operative Electrical Development Association were embodied practically the same thoughts, ideas and plans which are expressed in the constitution of the Society for Electrical Development, Inc., and to the inspiration given at that time belongs the credit for the present society, which was outlined at the meeting held on Association Island Sept. 3, 1912, as noted in our issue dated Sept. 7, 1912.

The membership of the society, as stated in the by-laws, is open to every interest in the electrical industry, and the subscriptions, based upon a small percentage of the gross business, are so small individually that it is believed that the full co-operation of every concern in the electrical industry can be secured. In our issue dated Oct. 26, 1912, were outlined the plans for financing the society.

The society has the indorsement of the executive committee of the National Electrical Contractors' Association, the National Electrical Supply Jobbers' Association, the executive and public-policy committees of the National Electric Light Association, together with the support of a large number of manufacturers, both large and small. With such indorsement there can be very little question of its practicability and value to the industry at large.

Midwinter Convention of the A. I. E. E.

Arrangements have been completed for the midwinter convention of the American Institute of Electrical Engineers, which will be held under the auspices of the standards committee in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, from Feb. 26 to Feb. 28. Papers for the convention have been secured with the object of providing data for the revision of the standardization rules. As will be noted, two of the papers have been prepared by sub-committees of the standards committee. These papers will be widely distributed prior to the convention in order to invite written discussions. Such discussions as are received before Feb. 10 will be printed for distribution at the convention. The other papers have been arranged in four groups as shown below.

SUB-COMMITTEE PAPERS

"Temperature and Electrical Insulation," by Dr. C. P. Steinmetz and Mr. B. G. Lamme, of the sub-committee on revision of rules; "Method of Rating Electrical Apparatus," by Messrs. W. L. Merrill, W. H. Powell and Charles Robbins, of the sub-committee on rating.

GROUP I—HEATING, HEAT MEASUREMENTS AND RATING BY HEAT

Moving Machinery.—"Notes on Internal Heating of Stator Coils," by Mr. R. B. Williamson; "Measurement of Temperature on Rotating Electric Machines," by Messrs.

L. W. Church, E. I. Chute and O. W. A. Oetting; "Method of Determining Temperature of Alternating-Current Generators and Motors and Room Temperature," by Messrs. H. G. Reist and T. S. Eden; "Thermocouples and Resistance Coils for the Determination of Local Temperatures in Electrical Machines," by Messrs. L. T. Robinson and J. A. Capp.

Transformers.—"Methods of Determining Temperature of Transformers and of Cooling Medium," by Messrs. S. E. Johannssen and G. W. Wade; "Methods of Measuring Temperature of Transformers," by Messrs. C. Fortescue and W. M. McConahey; "Correction of Transformer Temperature for Variation of Room Temperature, Taking Into Account Both Copper and Iron Losses," by Mr. C. Fortescue.

Temperature Correction.—"Temperature Rise of Stationary Induction Apparatus," by Messrs. J. J. Frank and W. O. Dwyer; "Effect of Room Temperature on Temperature Rise of Motors and Generators," by Messrs. M. W. Day and R. A. Beekman; "Effect of Air Temperature, Barometric Pressure and Humidity on the Temperature Rise of Electrical Apparatus," by Messrs. C. E. Skinner, L. W. Chubb and Phillips Thomas; "A Laboratory Investigation of Temperature Rise as a Function of Atmospheric Conditions," by Messrs. C. B. Blanchard and C. T. Anderson; "Laws of Heat Transmission in Electrical Machinery," by Mr. Irving Langmuir.

Cable Heating.—"Current Rating of Electric Cables," by Messrs. R. W. Atkinson and H. W. Fisher; "The Heating of Cables Carrying Current," by Mr. S. Dushman.

GROUP II—METHODS OF DETERMINING LOSSES IN APPARATUS

Induction Motors.—"Induction-Motor Load Losses," by Messrs. H. C. Reist and A. E. Averrett; "Stray Losses in Induction Motors," by Mr. A. M. Dudley; "Notes on Induction Motor Losses," by Mr. R. W. Davis.

Transformers.—"Losses in Transformers," by Mr. W. W. Lesis; "Stray Losses in Transformers," by Messrs. C. Fortescue and W. M. McConahey.

Generators.—"Determination of Load-Loss Correction Factors for Rotating Electric Machines," by Messrs. E. M. Olin and S. L. Henderson; "Load Losses of Alternating-Current Generators," by Messrs. W. J. Foster and E. Knowlton; "Notes on Stray Losses in Synchronous Machines," by Mr. F. K. Brainard; "Stray Losses in Direct Commutating Machines," by Messrs. H. F. T. Erben and H. S. Page.

Errors of Tests.—"The Determination of Stray Losses from Input-Output Tests," by Mr. L. T. Robinson; "Sources of Error in Efficiency Determination of Rotating Electric Apparatus," by Messrs. Elmer I. Chute and William Bradshaw.

Brush Losses.—"Commutator and Brush Losses," by Mr. W. N. Motter; "Brush Friction and Contact Losses," by Messrs. H. F. T. Erben and A. H. Freeman; "Methods of Determining Brush Losses Due to Contact and Friction," by Messrs. H. R. Edgecomb and W. A. Dick; "Commutation and Brush Losses," by Mr. C. E. Wilson.

GROUP III—METHODS FOR TESTING APPARATUS FOR PERFORMANCE

Generators and Induction Motors.—"Comparison of Methods of Loading Large Alternating-Current and Direct-Current Generators and Synchronous Converters for Factory Temperature Test," by Mr. F. D. Newbury; "Comparison of Methods of Making Load Tests on Alternating-Current Generators and on Induction Motors," by Messrs. E. F. Collins and W. E. Holcombe; "Notes on Methods of Making Load Tests on Large Induction Motors," by Mr. A. M. Dudley.

Transformers.—"Load Tests on Transformers," by Mr. J. J. K. Madden; "Sources of Error in Transformer Tests," by Messrs. W. M. McConahey and C. Fortescue.

GROUP IV—MISCELLANEOUS SUBJECTS RELATING TO RATING

Oil Switches.—"Rating of Oil Circuit-Breakers with Reference to Rupturing Capacity," by Mr. G. A. Burnham.

Spark-Gap.—"The Sphere Spark-Gap," by Messrs. S. W. Farnsworth and C. Fortescue; "Calibration of Spark-Gap," by Messrs. L. W. Chubb and Dr. Phillips Thomas.

Wave Form.—"Potential Waves of Alternating-Current Generators," by Mr. W. J. Foster; "Wave-Form Distortions and Their Effect on Electrical Apparatus," by Mr. P. M. Lincoln; "A Proposed Wave-Shape Standard," by Mr. Cassius M. Davis.

Regulation.—"The Experimental Determination of Regulation of Alternators," by Mr. A. B. Field; "Regulation of Definite-Pole Alternators," by Mr. S. H. Mortensen; "Generator and Prime-Mover Ratings," by Messrs D. B. Rushmore and E. A. Löf.

The opening session will be held at 10:30 a. m. Wednesday, Feb. 26. There will be morning, afternoon and evening sessions on each day, with the exception of the evening of Feb. 28, when a reception and dance will be held at the Hotel Astor.

Automobile Shows in New York

The first section of the automobile shows held in Madison Square Garden and in the New Grand Central Palace this week was devoted to pleasure cars and accessories. Owing to the inability of makers of electric pleasure cars to obtain good locations, however, electric automobiles were conspicuous by their absence, not a single manufacturer being represented in the Garden show and only four at the Palace. Electric lighting and electric starting are the feature of the year in the gasoline cars, 69 per cent of the gasoline cars equipped for self-starting being fitted with electric starters. Last season the explosive-gas type of self-starter predominated, but this year only 15 per cent of the cars are thus equipped. It is evident that almost all manufacturers of gasoline automobiles are equipping their cars with self-starters regardless of the selling price of the car. The shows next week will be devoted to commercial vehicles and accessories and a large number of electric cars will be on display.

Annual Meeting of the I. E. S.

At the annual meeting of the Illuminating Engineering Society, held at the Aldine Club on Jan. 10, the speakers included the retiring president, Mr. V. R. Lansingh, President-elect Preston S. Millar and Secretary-elect Joseph D. Israel, of the Illuminating Engineering Society, and Mr. W. R. Addicks, president of the American Gas Institute; Mr. J. W. Lieb, Jr., past-president of the American Institute of Electrical Engineers; Mr. T. C. Martin, executive secretary of the National Electric Light Association; Dr. William H. Tolman, director of the American Museum of Safety, and Messrs. A. E. Kennelly, C. H. Sharp and L. B. Marks, past-presidents of the Illuminating Engineering Society. Both the incoming and the outgoing presidents emphasized the fact that the Illuminating Engineering Society is performing highly important work in co-operation with other societies dealing either directly or indirectly with light or eyesight. The society has established reciprocal relations with thirty-two other societies, and its co-operation with them has proved highly successful. In addition to President Millar and Secretary Israel, the election of the following officers was announced: Vice-president from the Philadelphia Section, Mr. William J. Serrill; vice-president from the New England Section, Mr. J. W. Cowles; vice-president from the Chicago Section, Mr. J. R. Cravath; vice-president from the Pittsburgh Section, Mr. H. S. Evans; treasurer, Mr. L. B. Marks; directors, Messrs. C. O. Bond, P. W Cobb and W. Cullen Morris.

Municipal Street Lighting in Milwaukee

By a recent decision of the Supreme Court of Wisconsin, the city of Milwaukee may construct a municipal electric street-lighting plant without obtaining a certificate of convenience and necessity from the Railroad Commission of Wisconsin. In 1904 the voters of Milwaukee ratified a $500,000 bond issue for the construction of such a municipal lighting plant. Subsequently another issue of $150,000 was made, but this was declared illegal by the Supreme Court. A special act of the last Legislature made it legal, however. A site was acquired on Davidson Street, between Mineral and Walker Streets. The city then authorized a new bond issue for $100,000 and $300,000 in mortgage certificates. The proposed plant is intended to supply street lighting and illumination for city buildings, and is not to be placed in competition with private companies engaged in commercial lighting. Mr. T. J. Neacy started suit to prevent the further sale of bonds, on the ground that the city had not obtained a certificate of convenience and necessity, as required by the utilities law. The recent decision of the Supreme Court is to the effect that in this case the city need not obtain a certificate from the Railroad Commission.

Recently the Railroad Commission, which has been investigating the street-lighting system in Milwaukee, made a report in which it recommended that the city employ an illuminating engineer, to be retained permanently, if possible, and that this engineer select the types of lamps for street lighting and fix their locations.

Chicago Drainage Canal Power

Secretary of War Stimson has made a decision refusing the additional diversion of water from Lake Michigan for the Chicago Drainage Canal sought by the trustees of the Sanitary District of Chicago. The Secretary of War says that the Drainage Canal has never received the direct sanction of Congress. He thinks that the withdrawal of 10,000 cu. ft. a second would interfere with the navigable capacity of the Great Lakes and their connecting rivers. In 1899 the Secretary of War permitted the Sanitary District to take 5000 cu. ft. of water per second from Lake Michigan. About $70,000,000 has been spent in building the canal and the works connected with it. A water-power was created by the flow of water and a 28,000-kw hydroelectric plant has been built and is in operation at Lockport, Ill., a large portion of the electrical energy being used for the purpose of lighting the streets of Chicago. In relation to this water-power development, Mr. Stimson says that for every horse-power realized at Lockport 4 hp could be produced at Niagara, where the natural conditions are much more favorable. On the part of the city of Chicago, it is urged that the present canal represents the development of a national policy for uniting the waters of Lake Michigan and the Illinois River which goes back to 1827. The matter will undoubtedly come up in Congress, and the members from the Chicago districts hope that legislation sanctioning the additional flowage will be enacted. It is not believed, however, that any action will be taken affecting the existing hydroelectric development.

Myriawatt as the Boiler-Horse-Power

As a result of the presentation of a paper on "The Myriawatt," by Messrs. H. G. Stott and Haylett O'Neill, at the Boston convention of the American Institute of Electrical Engineers, June, 1912, mentioned on pages 2 and 32 of our issue dated July 6, 1912, the term "myriawatt" will doubtless be officially substituted for "boiler-horse-power" by both the Institute and the American Society of Mechanical Engineers. At a recent joint meeting of committees of these two societies it was unanimously resolved to recommend the exclusive use by the societies of the term "myriawatt" in connection with boilers, producers, turbines and engines and the discontinuance of the use of the term "boiler-horse-power." It was also resolved that Mr. C. O. Mailloux be requested to bring the joint resolution formally to the notice of the International Electrotechnical Commission at Zurich, Switzerland, Jan. 18, 1913.

The resolutions passed in this connection represent the first piece of joint standardization work that has been accomplished between two of the national sister engineering societies having their homes in the Engineering Societies Building, New York City. The resolutions indicate and recommend a simple and satisfactory method of rating the input and output of turbo-generators in terms of one and the same unit—the international watt. Instead of rating the output of a turbo-generator in kilowatts and the input in boiler-horse-power or other heat units, as at present, it becomes very convenient to rate the electrical output in kilowatts and the steam input in myriawatts, because the myriawatt is approximately the same as the boiler-horse-power while it is also exactly ten kilowatts. By this means the long-existing incongruity of stating the input and output in different and disconnected units of power will be eliminated.

Development of the Electric Vehicle

The New England Section of the Electric Vehicle Association of America and the Electric Motor Car Club of Boston held a joint meeting at the Hotel Thorndike, Boston, Mass., on Jan. 10, the feature of the evening being an address by President Arthur Williams of the former organization on "The Development of the Electric Vehicle." Mr. Williams pointed out that there are now about 30,000 electric vehicles in use in the United States, 6000 electric pleasure cars and 4000 commercial machines having been manufactured in 1912. The early machines, which date back about twenty years, were clumsy, expensive and not always dependable, the batteries being heavy and useful only for short-distance service, besides requiring expert handling. In spite of these difficulties several models built in 1899 are still giving good service, and a truck in Philadelphia which was built in 1893 has not missed a day in the last four years. To-day the central stations are becoming aroused to the value of the electric-vehicle load and service; rates are lower for charging and the fields of the electric and gasoline machines are more clearly defined.

In New York the number of electric vehicles in service grew 45 per cent between the summers of 1911 and 1912, and in the last two years electric trucking has increased 400 per cent in Chicago. President Williams accorded high praise to the Boston Edison company's electric-vehicle campaign and to the work of Past-president W. H. Blood, Jr., in connection with the development of the industry. Since the Public Service Corporation of New Jersey entered the campaign two years ago the number of electric vehicles in its territory has risen from 139 to 440 and the average cost of charging service has been reduced from slightly over 4 cents to about 3.5 cents per kw-hr. In the past three years the number of commercial electric vehicles in Boston and vicinity has risen from about sixty to nearly 300. About 80 per cent of the commercial "electrics" are used east of the Alleghanies, the heaviest demand for pleasure cars coming from the Middle West. Chicago operates 2200 of the latter and New York 1700 trucks and delivery wagons of the electric type. The speaker emphasized the important part the association has played in harmonizing the manufacturing, central-station and accessory interests. In two years the original twenty-nine members have grown to 350, representing seventeen electric vehicle makers, fifty-six central stations and some ten manufacturers of accessories, with a combined capital ac-

count of over $500,000,000. The standardization of the charging plug and garage sign and the stimulation of the garage business, the national advertising campaign of the last two years and other activities of the organization were outlined. A fund of at least $42,000 will probably be raised again this year for publicity. Ten years ago the price of energy for charging averaged about 23 cents per kw-hr. throughout the United States compared with from 5 to 3 cents to-day. Meanwhile the price of gasoline has risen from 10 to 24 cents a gallon, and higher prices are probable. Electrical energy tends to fall still lower in price, particularly for off-peak loads.

Mr. Williams brought out the point that a recent investigation of the battery-charging load curve in New York, with special reference to the express business, showed that with no restrictions on the use of energy demand was not made for a single kilowatt-hour before 7 p. m., in spite of a total consumption at the rate of 1,000,000 kw-hr. a year. The off-peak character of the load is thoroughly established. Referring to the selling situation in New Jersey, the speaker showed by analysis that 185 gasoline automobiles in the electric-truck class are the products of ninety-eight makers, while 191 comparable "electrics" came from only nine factories. Nine electric competitors were able to sell more cars than ninety-eight opponents. An output of 15,000 electric vehicles is predicted by some authorities for 1913. Within a few days the New England Casualty Company of Boston has notified the Electric Vehicle Association of America that after a careful study of conditions the company has arranged to grant a large reduction of rates to electric vehicles, a decrease which will bring electric motor car insurance 20 per cent below prevailing rates for gasoline machines.

The importance of the electric truck as a means of raising the efficiency of terminal and warehouse delivery service was discussed at length, and Mr. Williams stated that enormous savings in time, money and transportation charges ought to be realized through the substitution of the motor truck for the slow and cumbersome horse. Street congestion can be greatly decreased by the use of electric trucks at night. It is estimated that the electrification of the trucking service to and from six of the important railroad terminals in Chicago would save $4,320,000 a year in transportation. Such economies would tend to decrease the retail cost of many articles. In closing, the speaker drew an inspiring picture of the future of electric trackless transportation and outlined the further usefulness ahead for the association in promoting co-operation, standardizing equipment, establishing new branches—Boston, New York, Chicago, Philadelphia and San Francisco now being represented in this way—and in stimulating the public, the manufacturer and the central station to further the use of this important economic agency.

Discussion

An extended discussion followed the presentation of Mr. Williams' address. Past-president Blood called attention to the great value of statistics in the development of the industry and cited an increase in the riding habits of many American cities of about 100 per cent in the past ten years, as deduced from a recent extended investigation of per capita travel per year in many parts of the country. Facilities for quicker transit stimulate patronage, and the electric vehicle is bound to feel the effects of this tendency. Mr. Converse D. Marsh, New York, emphasized the importance of a horse census in mapping out the electric vehicle market in any city, and gave $190 as a fair average cost of horse feed and bedding per year. This money should, with a proper reduction for the increased efficiency of the electric vehicle, be turned into the coffers of the central station instead of being consumed by the thousands of isolated plants walking the streets on four legs. Mr. W. P. Kennedy, New York, described an investigation of several weeks' duration into the location of stables and cost of horse provender in Greater New York, which resulted in the card indexing of substantially every horse installation in the city. There are 120,000 horses in the metropolis, with a feed bill of $27,156,000 per year. In the solicitation of electric-vehicle sales a knowledge of these horse costs in individual cases is most valuable.

Dr. Harold Pender, Boston, touched upon the saving in time possible by motor trucks compared with horse-drawn vehicles in railroad yards, basing his remarks upon extended observations by the Massachusetts Institute of Technology. The work can be done in about 60 per cent of the time by a motor truck, according to timing tests upon 200 teams and forty trucks of 3.5-tons average capacity. Delays are cut down and backing up, loading and movements in congested areas and streets are greatly improved by the electric truck. Colonel E. W. M. Bailey, Amesbury, Mass., pointed out that the electric passenger car will now perform about 90 per cent of the service required by an automobile owner and at 25 per cent less cost. Mr. D. C. Tiffany, Boston, cited an instance where a former gasoline touring car owner had disposed of his machine in favor of an electric car, having recourse to a hired gasoline touring car for long trips with large parties. The resulting economy proved to be striking. Mr. S. Fred Smith, Salem, Mass.; Mr. M. J. Fitch, Lynn, Mass., and Mr. Day Baker also spoke briefly, Mr. Baker laying special emphasis upon the adequate battery equipment of the vehicle units in the Springfield (Mass.) fire department service. Mr. F. J. Stone, Boston, pointed out that interchangeability of batteries should present no mechanical difficulties where service conditions render it desirable.

Activities of the National Contractors' Association

Mr. Ernest Freeman, president of the National Electrical Contractors' Association of the United States, gave an account of the work of that organization at the luncheon of the Electric Club of Chicago on Jan. 9. The association has now about 1250 members. One of its accomplishments has been the introduction of standard symbols in wiring plans. It issues a "Universal Data and Sales Book," which is of much value to contractors, jobbers and dealers. This book, bound in loose-leaf style, gives wholesale and recommended re-sale prices on practically every item entering into electrical construction work. It also contains data sheets showing wage scales, inspection charges, etc., in various cities. The proper way to figure cost of doing business is explained. This book is sold to members and is kept up to date by renewal sheets issued from time to time from the association's office.

Another important feature of the association's work is co-operation with the National Fire Protection Association in the consideration, amendment and improvement of the National Electrical Code for electric wiring. The contractors are also trying to bring about standardization in such matters as the shape and dimensions of cut-out boxes and the finishing (as "oxidized copper," for instance) on lighting fixtures. A committee of the association on legislation keeps track of such matters as laws or proposed laws relating to the licensing of contractors in the various states. It has also done useful work in publishing charts showing the size and disposition of wires going into the various sizes of conduits. Mr. Freeman spoke with approval of the work of the new Society for Electrical Development, Inc., with which the association of which he is president is co-operating. One thing that this society may take up is an investigation of the careless and usually unfounded newspaper statement that "the fire was caused by crossed electric wires." The speaker also referred to the *National Electrical Contractor*, the organ of the association, and described the methods adopted to build it up.

H. M. Byllesby on Centralization of Public-Utility Management

Since 1881, when as a youthful draftsman employed by the Edison Electric Light Company he assisted in making the plans for the historic Pearl Street station in New York City, Mr. H. M. Byllesby has been in close touch with electrical public utilities in this country. He is the president of H. M. Byllesby & Company, which he established ten years ago. This company, with headquarters in Chicago, operates forty-one public-utility companies scattered throughout seventeen states of the Union, from West Virginia to California. Mr. Byllesby is therefore in a position to speak with knowledge of modern tendencies in the operation of public-utility properties, and undoubtedly the most pronounced of these tendencies is that toward unification of control or ownership. He was asked for his views on this subject by a representative of the *Electrical World*, and in answer to a number of questions authorized the statement which follows:

A Movement That Is Well Conceived

"A movement has been going forward more or less continuously during the last fifteen years in the direction of placing the control and management of local utilities in different communities, which may be remote from each other, in the hands of one central organization. This movement probably had its inception as far back as the early work of the Thomson-Houston Electric Company, under the guidance of Mr. C. A. Coffin, or, still earlier, the work of the United Gas Improvement Company of Philadelphia, and subsequently that of Emerson McMillin & Company and Messrs. Stone & Webster. It has progressed with great rapidity during several years, and notably so in the year just closed. It is bottomed on sound economic principles and violates no theory regarding 'restraint of trade.'

"I believe the movement is well conceived and that, being economically sound in its principles, it will continue. The manifest advantages of the placing of the control of a greater or less number of utilities in the hands of one central management and control are so evident that they scarcely require notice. They embrace notably the beneficial and economic features which are mentioned below.

Advantages Enumerated

"(A) The purchasing of fuel, apparatus and supplies in wholesale quantities, for prompt payment in cash, with a resultant saving to the members of the group, as against their individual retail and haphazard action.

"(B) The standardization of methods of construction, accounts, apparatus and methods of conducting the business.

"(C) The proper handling of various classes of insurance, which can be done at a saving by a central organization dealing with large amounts, as against results to be reached by the individual properties independently. This applies equally to the placing of insurance with insurance companies or the carrying of the insurance by the combined properties themselves, which would be problematical in isolated situations.

"(D) The placing at the call of the individual utilities comprising any given group of a central expert staff, competent from broad experience to deal with the various complex problems confronting the utility business. These include engineering, construction, publicity, legal questions handled by an experienced, competent staff, and auditing.

"(E) The facility which this grouping affords for the economical finding of capital to supply the continual demands for extensions and enlargements of practically every utility situation.

"(F) The working out by the central organization of methods and appliances, looking to the further sale by the individual companies of their product, embracing gas, power, light, heat and transportation.

"(G) In addition to the foregoing, in a great many cases, is the foundation of the manufacturing plant by means of which one large modern, economically operating and generating plant can supply the product of what otherwise would be a number of smaller and more expensively operated stations.

"(H) By this grouping a number of utilities—each of them at a cost entirely with its means—are placed in possession of the benefits above recited, which would be largely if not totally beyond their reach under separate or isolated ownership and management.

Why the Plant Is Not Inimical to the Public Interest

"There is not an item in the foregoing inventory which is repugnant to any proper conception of economics or which leads to unfair restraint of trade or the curtailing of development, or violates any of the principles so prominently before the public at the present time. On the contrary, this plan, which centralizes the management and control of properties in different communities, is in accordance with the spirit of the times and along the lines of wise and economical practice.

"As in all developments, whether of the privilege and rights of the voter, whether as to the passing and administration of laws, the government of municipalities or the administration of the individual affairs of the commercial world, or in manufacturing or in private life, mistakes, errors and frauds are possible. This possibility, indeed, as everyone recognizes, is part and parcel of the primary conditions of human existence and will be so until Utopia is reached. In the theory of grouping, as such, however, and as practised so far as I know up to the present time, the results have been most satisfactory to the communities served and to investors. Many a small community to-day has at its call gas, electricity and transportation service of an excellence and at a cost which have been made possible only by the carrying out of the groupings herein referred to and which otherwise would have been totally and perpetually impossible. Where these groups of utilities are properly administered and carefully managed, the securities bottomed thereupon are fast taking their place among the soundest before the public. This is entirely in accordance with the results which should follow the facts.

On the Question of Regulation

"If the action of the governing bodies before which the utilities companies are compelled to appear is wise and prudent (and I believe the intention of the members of such governing bodies is to be judicial and fair), there will be nothing to interfere with the continual growth of such properties and their continued ability to provide, at a reasonable cost (in fact, it should be at the lowest cost), the capital required for their further useful and profitable development.

"A tendency of the times, however, should be checked. At least in some quarters, this tendency looks to the hampering of such corporations by unfair rules and legislation and results in taking from these corporations the thing which in the past has rendered their development possible; that is, the great and often underestimated element of personal enterprise and creative work.

There Should Be a Reward for Personal Enterprise

"Enterprise and creative work can continue only where, while preventing unfairness and fraud, rewards are allowed to follow the results of intelligent, successful enterprise. The history of economics points unerringly to the deduction that where laws and regulatory measures go beyond their proper function and dip into the unfathomable depths of paternalism and restrictive measures they always have resulted and always will result in putting a period to development and enterprise. In place of these, paternalism brings about the dead level of mediocrity, such as seems heretofore to have been its attendant, as emphasized by the large in-

efficiency of governmental bureaus, their officers and employees (with certain notable exceptions) working under the deadening conditions of their employment.

"It seems a grievous error to deal unfairly with these problems and thus destroy that magnificent creative capacity which has so distinguished the growth of the United States of America. The mass of our citizens will surely not be helped by any such course; the laboring man surely will not be, and if these measures should unfortunately (which I cannot believe) be carried to their extremes, we should shortly be endeavoring, when perhaps too late, to bring back to this country that constructive genius and that daring enterprise which have been great moving forces in our development."

Recommendations of Governors on Public Utilities

In last week's issue were printed abstracts of the recommendations of numerous governors bearing on public utilities. Excerpts from other messages which have been delivered during the week are given below. Aside from the very general desire for public service commissions in those states not already possessing them, and the strengthening of public utility acts in other states, there appears to be a unanimity of opinion on the moral obligation of the state to protect its citizens against stock-jobbing propositions. Very many of the governors have expressed themselves in no uncertain terms on this subject in suggesting legislation for the control of securities.

MICHIGAN

In his inaugural address to the Legislature, Governor Woodbridge N. Ferris of Michigan asked that the powers of the railroad commission be enlarged so as to cover all of the public utility corporations of the State. He recommended that the commission, which now has power to fix rates and regulate the practice of railroads, telephone and power companies, be authorized to make physical valuations of all such properties as it may deem advisable in order that the rates fixed may return reasonable dividends on the actual cash invested. The Legislature was also requested to enact a law similar to the "Blue Sky" law of Kansas, prohibiting the sale of stocks and bonds of any company until the matter has been investigated and approved by the railroad commission.

MONTANA

Governor S. V. Stewart, in his first official communication to the Legislative Assembly of Montana, made a plea for a public service commission law, the enforcing of which would devolve on the present Board of Railroad Commissioners, in order to obviate the necessity for and expense of a new commission. A law providing for the supervision of all investment companies and promotion enterprises in the State was also suggested, as well as a law regulating the appropriation and use of water for power purposes. Another piece of legislation recommended by the Governor was a law defining the liability of employers and regulating compensation of employees for accidents received in the course of employment.

WISCONSIN

In his message to the Wisconsin Legislature Governor Francis E. McGovern renewed his recommendations for water-power legislation. The first reason assigned for such legislation was the need of public control of the location, construction, height and strength of dams, their sluices and spillways, in the interest of improvement in navigation and safety to life, health and property. In the opinion of the Governor, the State in the exercise of its police power has ample authority to regulate this whole subject in the interest of public safety and the general welfare. The second reason for such legislation was given as the desirability of providing now for attaining ultimate ownership and operation by the public of all water-powers in the State. This object, it was stated, can be accomplished by providing just and satisfactory means for the condemnation of dams, water and power sites and riparian rights by public utilities, municipalities and the State itself whenever it shall have the constitutional power to acquire and operate them. The third argument given is the desirability of prompt development of water-powers and the harmonizing of public and private rights upon a basis just and fair to all. In addition, Governor McGovern expressed the opinion that in so far as hydraulic energy is required for public purposes the State should reserve the right to compel the maximum development of water-powers for which franchises are granted. In all authorizations to build dams it should require, in cases where the energy may be used either within the State or outside its borders, that its own citizens shall have the preference.

MISSOURI

In his inaugural address Governor Elliott W. Major of Missouri recommended the passage of an efficient public service commission law, with adequate powers given to the commission to fix and regulate freight and passenger rates, express rates, telegraph and telephone rates, the charges of electric light, gas, water and power companies and all other public-service corporations doing business in the State. The commission should have authority to supervise the issuance of stocks and bonds and other evidences of indebtedness and also the further power to ascertain the value of the physical properties of the public utilities coming within the provisions of the act. The salaries of the commissioners, he said, should be fixed at a reasonable amount commensurate with the service required of the commissioners and other employees and sufficient to insure that able and competent men will be willing to serve upon it.

MINNESOTA

In his second inaugural message to the Legislature of Minnesota, Governor Adolph O. Eberhart voiced the necessity of creating a department of public domain to control the State lands, timber and minerals, as well as waterways, water-powers and drainage. Very few states, he said, possess greater water resources than Minnesota, and if every section of the State is to be developed so as to secure for every home, farm and industry the cheapest method of transportation as well as the cheapest light, heat and power, it is of vital importance that the State shall consider the regulation of water rights and water-powers and not delay action until they have been acquired by private enterprise. On the subject of public utility commissions the Governor said that public utilities must be either owned or controlled by the people. Where the control can be vested in a fair, impartial and competent authority removed as far as possible from political influence it is far superior to ownership. It has been found by experience that it is very difficult to keep municipally owned plants out of politics, and the Governor stated that as a general principle the state or city should not go into any business which can be transacted as well by individuals. He suggested that the Legislature enact a utility law that will bring the greatest benefits to the people at large and also a law preventing the issue and sale of stocks and bonds which have little or no value.

OHIO

While the existing law gives to the Ohio commission the right to make a physical valuation, Governor James M. Cox in his first message to the Legislature suggested that the law be made mandatory. The home rule amendment recently carried gives the municipality the right to own and operate utilities, and the Governor maintained that the Utilities Commission should have the right to enforce the same system of uniform accounting on municipally operated

utilities as is now imposed upon private enterprises; otherwise the public will have no means of knowing whether municipal plants are conducted along the lines of efficiency and economy. Simple fairness suggests that in the operation of utilities both private and public ownership must be subject to the same standards of ethics and government. He also suggested a law providing that, in controversies between the commission and a public utility, a court should not be permitted to issue an injunction in rate matters without an investigation.

Iowa

Governor G. W. Clarke of Iowa in addressing the members of the Thirty-fifth General Assembly said that it can and ought to render a great public service by passing a well-considered public utilities bill. While the State has the power to control all public service corporations, it seemed to the Governor that its intervention should only be to supervise and regulate in the interest of the common good. In his estimation the local municipality should govern and control so far as it can, and the State should add its strength where municipalities cannot obtain the experts and legal ability to cope with the syndicate. No conditions should ever be allowed to exist, according to Governor Clarke, that place an individual or a group of men at a disadvantage in dealing with a combination of men and money, and especially with corporate organizations authorized by the State to render a public service. He felt it to be the duty of the State to help the municipality in the matter of valuation of plants, reviewing of rates, examination of books, cost of maintenance, and such matters, to the end that the public shall have good service at fair rates in the matter of public necessities, water, light, heat and transportation.

Colorado

Governor Elias M. Ammons in his inaugural address to the members of the Nineteenth General Assembly of the State of Colorado, after expressing the hope that the General Assembly will enact a measure to eliminate from the State bad promotion schemes of all kinds, voiced the need of effective regulation of public utilities in the interest of good service and just rates. The Railroad Commission of the State, he said, proposes amendments to the law under which it is operating to make it more effective but suggests no plan for including other public utilities. Bills have also been prepared which comprehend the entire field of public utilities, and the Governor expressed opposition to two commissions so long as the matter could be handled by the Railroad Commission. He said it is exceedingly important, if the State is to insure a more liberal policy from the federal government in opening up its natural resources such as water-power, that it shall take some affirmative action to control these resources against monopolization. While at the recent election the people voted down two measures for the control of public utilities, the Governor felt that the faulty provisions contained in both were quite sufficient to account for their defeat independently of the real question at issue, and that the vote is no indication that the people are opposed to proper regulation.

Public Service Commission News

Massachusetts Commission

The Massachusetts Gas and Electric Light Commission has issued an exhaustive decision reducing the price of gas in the city of Haverhill from 85 to 80 cents per 1000 cu. ft., following a protracted investigation arising from complaints by the Municipal Council and by consumers supplied by the Haverhill Gas Light Company. The decision includes an extended discussion of the conditions involved, contrasts the contentions of the parties and reviews the policies of the State in relation to public-utility regulation, with particular reference to capitalization, return upon the investment, depreciation and surplus accounts. A large part of the decision sets forth the views of the commission along lines of interest to electric as well as gas service companies.

A feature of the case was a motion of the company, which is one of the Stone & Webster properties, to dismiss the complaints because of estoppels alleged to exist against the complainants. In 1910 the Municipal Council granted a franchise to the Haverhill Gas Company, a new corporation organized by the same interests, including price stipulations among the conditions of the grant. The complaint was brought in part by the Municipal Council of 1911, and the board holds that such action was legal in view of the fact that the Municipal Council has no authority to fix prices, such being the function of the commission.

The company contended that a fair price should cover its operating expenses, an allowance for depreciation and a fair return upon the value of its property at the time the controversy arose, including its franchises and privileges, that such value may be proved by the actual cost and reproduction cost of the property and by the amount and market value of its stock and bonds, and that the fixing of a price which will not afford a fair return upon such value amounts virtually to confiscation. Taking its actual cost of 62 cents per 1000 cu. ft. and allowing 8 cents for depreciation and a return of 22 cents, or 6 per cent on $900,000, for the value of its property and annual sales of 250,000,000 cu. ft. to a population of 44,000, the company claimed that a fair present price would be 92 cents, and that the reduction which might come with an increased output was already anticipated in the price of 85 cents which it had already offered.

The city urged that the fair price depends upon the cost at the burner, including a proper allowance for repairs, renewals and depreciation, and a capital charge based upon the capital stock duly issued, and not necessarily upon the value of the property owned by the company. The city contended that 60 cents was a fair and liberal price, allowing 3.5 cents per 1000 cu. ft., or a return of 10 per cent on the capital stock outstanding. The company claimed that its surplus was built up because it had for many years refrained from dividing all the earnings which might have been legally and properly declared in dividends.

Discussing the policy of the State with respect to security issues, the board emphasizes the plain legislative purpose to prevent the issue of stock for anything besides cash and points out that the prohibition of stock dividends and the provisions for the sale of additional stock at auction or its distribution to the stockholders at a price not so low as to be inconsistent with the public interest are also indications of an early and consistently maintained purpose to prevent surpluses accumulated out of earnings becoming the basis, directly or indirectly, for the issue of stock. On the other hand, no specific limitation has ever been placed upon rates or dividends with a view possibly of rewarding zeal in the skilful conduct of the business and imposing upon the directors, subject to the check of public opinion, a consideration of the welfare of the shareholders and the equities of consumers in the surplus to which they had contributed. The whole body of legislation is plainly designed to allow no capital stock to be issued save for physical property necessary for proper corporate purposes, to keep the authorized issue of capital stock as low as market and other conditions warrant, to compel publicity of corporate affairs, and, on the other hand, to secure the community from the wasteful effects of competition by the exclusion of others from territory already adequately and efficiently supplied, and to provide upon complaint a compulsory regulation in price and so to create a status favorable to low rates and adequate service.

The board states that, in view of the fact that the company has borrowed its present floating debt at an average

rate not exceeding 4.5 per cent and that stocks of successful gas companies in the State are continually traded in on nearly as favorable basis, the allowance of a return of less than 6 per cent is not subject to the charge of confiscation. The several valuations set forth by the parties with such "delusive exactness" should show that rate-making has not yet achieved the position of an exact science. The commission believes that the price named is fair and reasonable and that it will be sufficient to cover all reasonable operating costs, a reasonable allowance for depreciation and a fair return upon the value of the property which the company is actually and necessarily employing for the public convenience. In viewing the subject of depreciation the board states that any future depreciation allowance is the measure of those demands which intelligent management and a wise foresight find necessary for maintaining the property at its normal efficiency. Provision for depreciation, according to the board, is designed only to keep a plant good. The commission points out that it cannot concede the company's claim that franchise or going-concern value should form a part of that property on which a reasonable return should be based.

Ohio Commission

On complaint of a moving-picture theater against the Middletown Gas & Electric Company, Middletown, the commission has issued an order reducing the rate. The theater possesses a lighting plant, but maintains a connection with the central station also. For this service the company made a charge of $3 per kw a month in addition to 3 cents per kw-hr. for energy used. The connected load was 8 kw, making the fixed charge for the service $24. The commission ordered that there should be no charge for energy used until an amount equaling $24 a month has been consumed. With this order was another increasing the rates charged for energy actually used. For less than 150 kw-hr. the rate is to be 10 cents; for 300 kw-hr. 9 cents; for 600 kw-hr. 8 cents, and for over 600 kw-hr. 7 cents.

Maryland Commission

The Public Service Commission of Maryland has handed down a decision in the long-pending case against the Consolidated Gas, Electric Light & Power Company of Baltimore, ordering the company to establish a gross rate of 90 cents per 1000 cu. ft. for gas and 80 cents if bills are paid within ten days. The company is also ordered to file with the commission before June 1 wholesale rates based upon the quantity of gas consumed, these rates to be subject to the approval of the commission. The new rate ordered by the commission for electrical energy is 8.5 cents per kw-hr., with a minimum charge of $1 monthly. The company was also ordered to revise the terms and conditions under which electricity is now being furnished to the consumers. The new rates, which become effective July 1, compel a reduction of 10 cents in the base rate for gas and of 1.5 cents in the base rate for electrical energy. On the present basis of consumption it is estimated that the loss in revenue from gas will amount to $337,000 and that from electricity to $165,000.

New York Commissions

The Public Service Commission, Second District, has received a complaint from Mayor William Laughlin of the city of Niagara Falls, directed against the Buffalo & Niagara Falls Electric Light & Power Company as to charges for electricity by that corporation. The commission is asked to make an investigation and fix the reasonable maximum prices to be charged for electricity to be hereafter supplied to the city and its inhabitants. The rates now charged are $52 per annum per lamp for arc lamps for street lighting, 8.3 cents to 3.75 cents per kw-hr., and $25 to $35 per hp per annum for energy for motor circuits.

Current News and Notes

Diesel-Engine-Propelled Ship Crosses Atlantic.—The *Eavestone*, the first Carels Frères two-cycle Diesel engine to cross the Atlantic, arrived in Norfolk, Va., recently, after a voyage of about 4300 miles from Portugal, with a load of ore. The voyage was made in eighteen days and eighteen hours. The total amount of fuel oil consumed was 73½ tons, an average daily consumption of 7800 lb.

* * *

Available Water-Power in Michigan.—In a paper read recently before the Michigan Engineering Society Messrs. L. E. Ayres and B. K. Holland estimated the twenty-four-hour supply of water-power available in the State of Michigan at 631,500 hp, with possible annual income, at the rate of 1 cent per kw-hr., of $39,000,000. Prof. Horace W. King of the University of Michigan urged an inventory of the streams of the State.

* * *

Gifts to Electrical Department, University of Colorado.—The electrical engineering department of the University of Colorado at Boulder has recently added to its laboratory equipment a 100-lamp Brush arc-lighting machine, a number of series arc lamps, a Wagner booster and several transformers, the gift of the Denver Gas & Electric Light Company of Denver. A 60-kw single-phase Westinghouse generator with exciter has also been presented by the Glenwood Light & Water Company, Glenwood Springs, Col.

* * *

Civil Service Examination for Electrical Assistant.—An open competitive examination for electrical assistant will be held on Feb. 26 at the places mentioned on Circular No. 81 issued by the United States Civil Service Commission. The salary is $1,080 per annum. Applicants should be familiar with the practical side of electricity as applied to telegraph, telephone and kindred engineering and should be familiar also with the equipment and methods of installation of telephones, storage batteries, motor generators, auxiliary power switchboards, telephone switchboards and with wire and radio-telegraph apparatus. Form 1312, which can be had from the Civil Service Commission, contains the requirements for applicants desiring to take this examination.

* * *

Chicago Jovians Planning a Forward Movement.—At a dinner given by the members of the Jovian Order in and near Chicago on Jan. 10, Mr. A. A. Gray presided and speeches were made by Messrs. John F. Gilchrist, of the Commonwealth Edison Company; Mr. Ernest Freeman, president of the National Electrical Contractors' Association; Mr. Sam A. Hobson, past Jupiter; Mr. Ell C. Bennett, of St. Louis, Mercury; Mr. Frank E. Watts, of New York, reigning Jupiter, and Mr. George C. Richards, statesman for Illinois. Mr. Watts spoke, among other things, of the need of patent reform in the United States and said that the order would appoint a committee on the subject in order that its influence might be exerted for the purpose of improving present conditions. Of the Oldfield bill now pending in the House of Representatives, he said that it has many good features but that the compulsory licensing provision is objectionable. No bill of this character should be passed, Mr. Watts thinks, until it is considered carefully by a patent commission of business men. All the speakers dwelt on the great practical value of co-operation, for which Jovianism stands, and plans for strengthening the order in Chicago and its vicinity were discussed. It is expected that a rejuvenation will be held about the first of March and that another, on a very large and impressive scale, will be carried out during the annual convention of the National Electric Light Association in Chicago the first week in June.

SOCIETY MEETINGS

Western Association of Electrical Inspectors.—The convention of the Western Association of Electrical Inspectors will take place at the Planters' Hotel, St. Louis, Mo., Jan. 28, 29 and 30. Besides a number of papers there will be committee reports covering all sections of the National Electrical Code.

* * *

St. Louis Engineers Give a Dance.—The St. Louis Section of the American Institute of Electrical Engineers announces a formal dance at the Missouri Athletic Club on the evening of Jan. 25. Mr. S. N. Clarkson, power engineer for the Union Electric Light & Power Company of St. Louis, is chairman of the committee in charge.

* * *

Institute of Consulting Engineers.—At the annual meeting of the American Institute of Consulting Engineers, held at the Engineers' Club, New York, Jan. 14, Messrs. Henry Holgate, of Montreal, Canada, and Daniel Moran and Charles Sooysmith, of New York City, were elected members in council for three years. Twenty-two members attended the session, which was preceded by a dinner. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary-treasurer of the organization.

* * *

Rate Research Committee Forms.—At the meeting of the rate research committee of the National Electric Light Association in Cleveland on Jan. 10 and 11, there were present Chairman E. W. Lloyd and Messrs. R. S. Hale, F W. Smith, Edwin Gruhl, L. H. Conklin, S. E. Doane and W. H. Winslow, members of the committee; Mr. William J. Norton, secretary, and Messrs. Samuel Scovil, G. S. Merrill and M. E. Turner, visitors. The discussion related to the question of forms of rate schedule used by member companies. An effort is being made to ascertain what degree of uniformity there is among electric-service companies in the matter of forms for applications, contracts and schedules. The committee will try to eliminate excess matter in these forms.

* * *

Efficiency Society, New York, Jan. 27-28.—The annual meeting of the Efficiency Society will be held in the Engineering Societies Building, New York, Jan. 27 and 28. Monday morning's session will be devoted to the subject of organization, with Mr. Harrington Emerson presiding. Management will be the topic of the afternoon meeting, and in the evening Dr. F. A. Cleveland, director of the United States Commission on Efficiency and Economy, will preside at a discussion on governmental efficiency. "Industrial Relations" is the subject scheduled for Tuesday morning. On Tuesday afternoon Dr. Winthrop Talbot will conduct a discussion on industrial hygiene. Mr. H. F. J. Porter, 29 West Thirty-ninth Street, New York, is secretary of the Efficiency Society.

* * *

Annual Meeting of the New York State Electrical Contractors' Association.—The annual meeting of the New York State Electrical Contractors' Association will be held in Syracuse, N. Y., on Jan. 21. The business to come before the meeting will be the election of directors and officers for the coming year. The directors' meeting will be held at 9 a. m., followed by the meeting of the association at 10 a. m. There will be a banquet in the evening. The nominations for officers are: For president, Mr. Frederick Newman, of Newman & Son, electrical contractors, Albany, N. Y.; for treasurer, Mr. James Burns, of Schenectady, and for secretary, Mr. G. W. Russell, Jr., of New York. The delegates from New York City will be Messrs. Ryan, of Cleveland & Ryan; Strong, of the Tucker Electrical Construction Company, and Peet, of Peet & Powers.

New York Section, I. E. S.—The lighting of the Auditorium Armory, Atlanta, Ga., in which the National Commercial Gas Association held its 1912 convention, was the general subject of the joint meeting of the New York Section of the Illuminating Engineering Society and the National Commercial Gas Association, held in New York on Jan. 9. Mr. Robert F. Pierce presented a paper dealing with the lighting of Taft Hall, and Mr. James M. Coles read a paper on the lighting of Exhibition Hall. Taft Hall was illuminated by means of gas units placed on ten columns. Each unit consisted of fifteen upright burners surrounded by a translucent bowl, which served to direct a considerable portion of the light toward the ceiling, from which it was reflected to the working plane. The arrangement was such that 50 per cent of the useful light was received from the ceiling and 50 per cent through the bowl. The bowl was of such a size that its surface brilliancy was kept at about 1 cp per square inch. The actual light produced by the unit was shown by means of polar co-ordinates, on each of which was represented the light flux produced in each zone indicated. Exhibition Hall was lighted by means of elaborate gas chandeliers, each being about 10 ft. in height, 15 ft. in diameter and weighing about 1000 lb. In addition to certain small gas outlets for illuminating the fixture proper, each fixture contained fifteen closed gas lamps of the so-called "arc" type. Mr. Norman Macbeth announced that a joint meeting of the New York Section of the society would be held with the Municipal Art Society at the National Arts Club Gallery on Feb. 12. At this meeting the following papers will be presented: "Municipal Street Lighting," by Messrs. C. F. Lacombe and Arthur Williams; "Municipal Building Lighting," by Mr. Charles R. Lamb, and "Sign and Billboard Lighting," by Mr. O. J. Gude.

* * *

Meeting of Brooklyn Company Section, N. E. L. A.—Nearly 600 members of the Brooklyn Company Section, N. E. L. A., and a large number of out-of-town visitors gathered together Monday evening, Jan. 13, for the first meeting of the year. The paper of the evening, "Commercial Engineering," was read by Mr. James L. Wiltse. This paper indicated the important part that engineering now plays in the commercial development of the central station. It covered the necessity for and the present status of illuminating engineering, power engineering, electric automobile engineering and heating engineering and vindicated the practical value to the central station of this kind of work. A spirited discussion followed. The new general manager, Mr. W. F. Wells, spoke on the importance of membership in the Brooklyn Company Section, and ended by an appeal for co-operation to produce the best results. Mr. T. I. Jones, general sales agent of the company, then delivered an address on the "Development of Our Business During 1912." Mr. Jones' talk was illustrated with about 100 lantern slides, showing the growth of Brooklyn electrically during 1912 along all lines. His description of the methods of co-operation with electrical contractors which have been adopted and are now in use in Brooklyn was especially interesting, and the result shows how central-station business can be improved by intelligent work along these lines. Short addresses were then made by Mr. Cox, of the Public Service Electric Company; Mr. Littlefield, of the New York Edison Company; Mr. Becker, of the United Electric Light & Power Company; Professor Sever, electrical engineer of New York City; Mr. Brown, of the Westinghouse Electric & Manufacturing Company; Mr. Coleman, of the United Electric Light & Power Company; Mr. Rosenquest, of the Bronx Gas & Electric Company; Mr. Onken, of the *Electrical World;* Mr. Barton, of the New York & Queens Electric Light & Power Company, and Mr. Wintner, of the General Electric Company. The chairman, Mr. M. H. Bennett, announced the initiation of a campaign for new members.

New Terminal Post Office in New York—II

Electrical and mechanical equipment, wiring and illumination of the government building over the Pennsylvania Railroad yards. By L. B. Marks and J. E. Woodwell

THE electrical equipment of the post office includes a complete system of conduits and wiring for lighting and motor service, with feeders and meter switchboard, and separate distributing switchboards for delivering energy to the various branch lighting tablets and motors throughout the building.

In addition to the above, complete and separate conduit systems are provided to accommodate the future installation of telephones, automatic clocks, fire alarms, vault protection alarms, signals and call bells. These special systems are to be installed at the time the building is occupied.

The electric energy for lighting and motor service for the building is obtained over direct-current, three-wire, 120-240-volt circuits from the New York Edison Company. The total connected lighting load approximates 883 kw, using a three-wire distribution, and the connected motor load aggregates about 1000 hp, used in driving the various elevators, pumps, fans, etc.

The Edison service feeders enter the building from the center of the block between Thirty-first and Thirty-third Streets on the Eighth Avenue front, through four 4-in. conduits, each containing two 1,000,000-circ. mil cables and one 350,000-circ. mil cable. These cables terminate at the service switchboard of the New York Edison Company, located in the switchboard room where the entire supply of energy used in the building for both lamps and motors is recorded. From this service board connection is made to the motor-service switchboard by means of four 4-in. conduits, each containing one 1,000,000-circ. mil positive cable, one 1,000,000-circ. mil negative cable and one 500,000-circ. mil neutral cable. The 4-in. conduits are connected into special pull-boxes at the rear and base of each of the three switchboards, as hereinafter described.

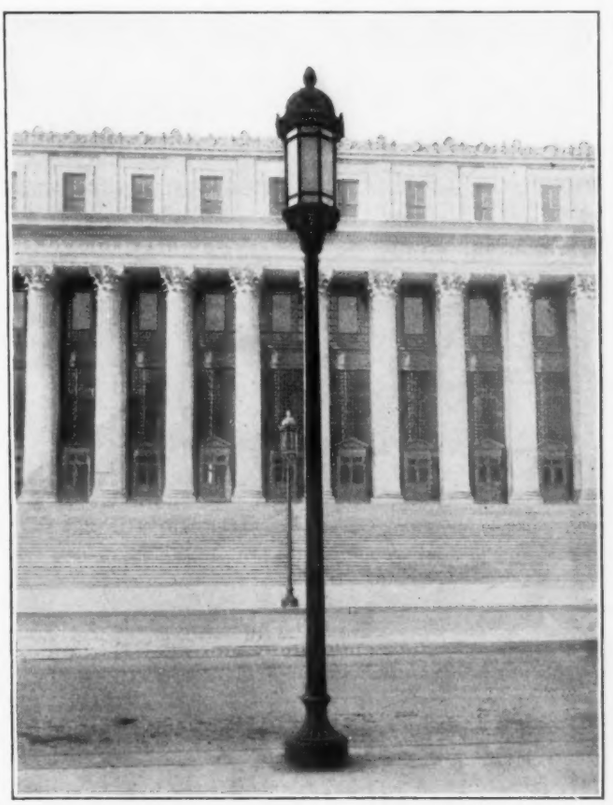


FIG. 1—ORNAMENTAL POSTS FOR LIGHTING EIGHTH AVENUE BETWEEN POST OFFICE AND PENNSYLVANIA TERMINAL

These three switchboards are located in the basement at a point as nearly central as possible, in order to secure the most uniform distribution to the various parts of the building. The lighting and motor-service boards are placed facing each other on opposite sides of the room, leaving a 4-ft. space behind each board, while the service meter board is located at one end of the room. Each of these boards is constructed of 2-in. thick blue Vermont marble panels, containing the various switches, meters and other instruments required in connection with the operation of the plant. The connections from the distributing switches on both the lighting and motor-service boards are made by means of copper rods run vertically to connector boards, located at the top and bottom of the board, as required to connect with the outgoing feeder cables.

For the purpose of reading the load on the various motor feeder circuits, the distributing switches are joined through shunts to two thirty-point multiple switches connected with two separate ammeters, one having a maximum reading of 100 amp and the other a maximum reading of 200 amp. Each of the distributing switchboards is provided with the necessary voltmeters, shunt-type ammeters and recording wattmeters, in addition to the meters located on the service meter board. The wattmeters are connected to double-throw switches in order that they may be bypassed for calibration.

At the rear of each of the distributing and service switchboards is placed a water-tight feeder pull-box of heavy steel construction, so located that conduits running under the basement floor may enter at the bottom of the box. The necessary crossing of feeders is done within the box, the top of which is provided with a continuous slot for leading cables to the connector lugs. The top of this box is entirely removable to permit access.

Owing to the great number of feeders necessary to be connected to the top lugs of the distributing switchboard, a cable racking space is provided over the entire switchboard room. The conduits from various tablets and motor outlets, located in the first-floor construction, are carried through the ceiling and plenum chamber of the ventilating system and terminate at the bottom of this duct with locknuts and bushings. The space for racking cables is formed by means of horizontal I-beams about 30 in. below

GENERAL DATA, ELECTRIC WIRING

Total number lighting outlets in building	3,700
Length of conduit for all systems, ft	160,000
Length of wire, No. 14 to 1,000,000 circ. mils, ft	300,000
Number of distributing tablets for lighting	73
Number of telephone outlets	200
Number of clock outlets	190
Number of vault outlets	8

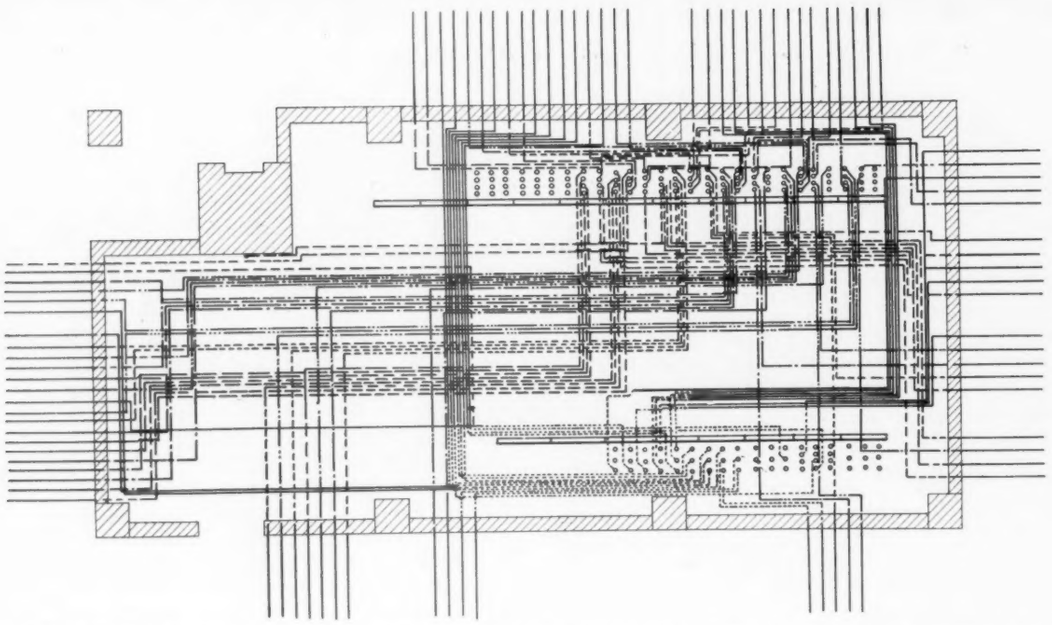


FIG. 2—DIAGRAMMATIC ARRANGEMENT OF FEEDER CIRCUITS FOR LIGHT AND MOTOR SERVICE IN SWITCHBOARD ROOM IN BASEMENT

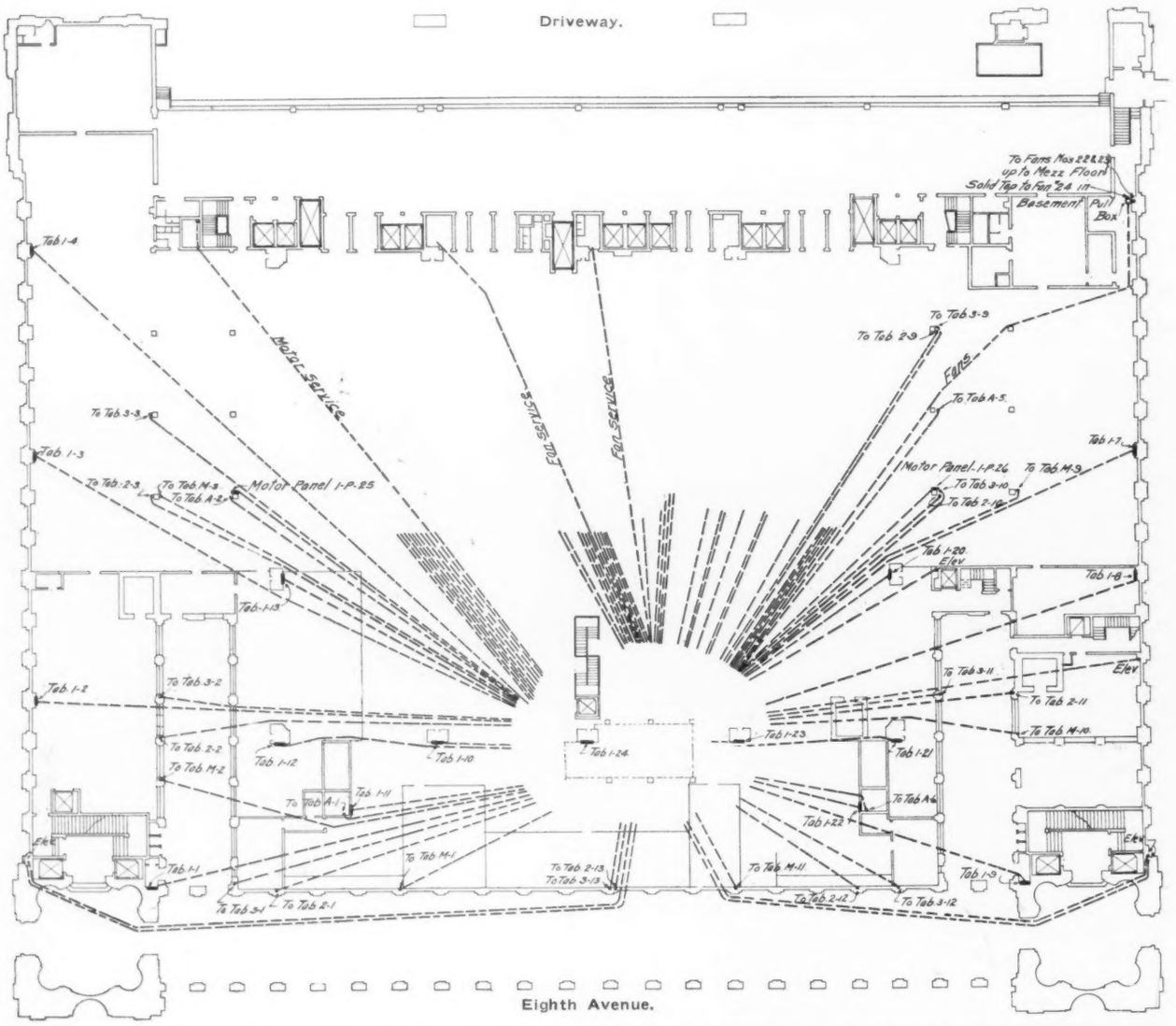


FIG. 3—FEEDER LAYOUT ON FIRST FLOOR, LEADING FROM SWITCHBOARD IN BASEMENT, FOR LIGHT AND MOTOR SERVICE TO THE SEVERAL FLOORS

the duct, and to these beams is secured a metal ceiling with removable plates. Within this overhead space vertical and cross-supporting angles are provided for attaching the insulating clamps by which the cables are secured. The arrangement of racking cables is carried out in symmetrical manner, various cables being carried in parallel rows and crossovers to the switchboard being made by dropping vertically and passing between the horizontal rows of cables.

The metal plates directly above the connector boards at the rear of the switchboards are made permanent and are provided with holes for porcelain bushings directly over each lug, thus providing for vertical exposed cable connections to all of the switch lugs.

Distribution Tablets.—For the sake of uniformity all lighting distribution tablets, seventy-three in number, are made up with twenty-four circuit switches to each tablet, with the exception of the two controlling the circuits in the public corridors and main stairways, each of which is provided with thirty-six switches. In all cases the tablets are contained in heavy metal boxes cut and bent from solid sheet metal. Panels of 1-in. blue Vermont marble with 0.75-in. gutter linings are used. Except in public corridors, the tablet trims and doors are made of sheet steel. In the public corridors special cast-iron trims are provided with ground plate glass in doors, these trims being made to match the fire-hose rack inclosures.

Conduit System.—All conduit work is run concealed within the floor construction, walls, partitions, etc., with joints made up with white lead and linseed oil. In locating the ceiling outlets wooden plugs were secured to the forms at the time the concrete floor arches were poured. These plugs were slightly tapered in order to permit them to be driven out from above after the forms were removed.

Use is made of outlet boxes of shallow type fitted with fixture supports consisting of a horizontal pipe slipped through a "Hickey" screwed to a vertical 0.5-in. pipe and secured to the box by lock-nuts. These fixture studs with the box and entering conduit were set plumb in the holes through the floor arch and then grouted in place with concrete.

Feeder Pull-Boxes and Floor Outlets.—All feeder pull-boxes are of special water-tight design, constructed of cast-iron shell with adjustable collar and floor plate of brass. Boxes are drilled and tapped for conduits in order to insure tightness. In the main workroom on the first floor special large floor boxes are used for connecting circuits

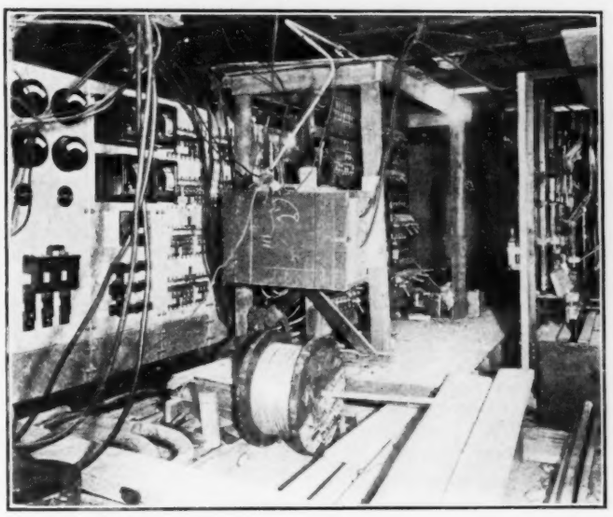


FIG. 4—SWITCHBOARD ROOM; MAIN LIGHTING SWITCHBOARD AT LEFT, MAIN MOTOR SWITCHBOARD AT RIGHT AND TEMPORARY SWITCHBOARD IN CENTER

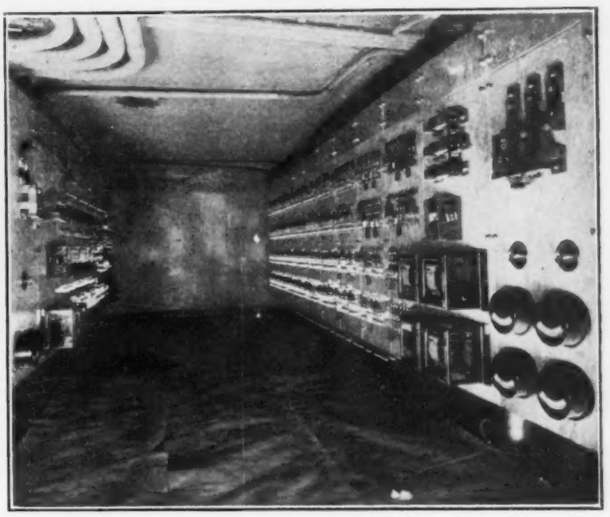


FIG. 6—SWITCHBOARD ROOM; MAIN LIGHTING SWITCHBOARD AT RIGHT, MAIN MOTOR SWITCHBOARD AT LEFT, CENTRAL-STATION-FEEDER SWITCHBOARD IN REAR

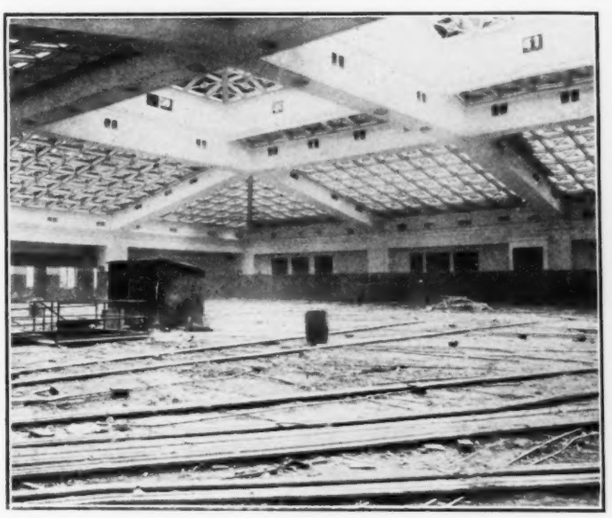


FIG. 5—GENERAL VIEW OF THE MAIN WORKROOM, FIRST FLOOR, SHOWING FEEDER CONDUITS FOR LIGHT AND MOTOR SERVICE

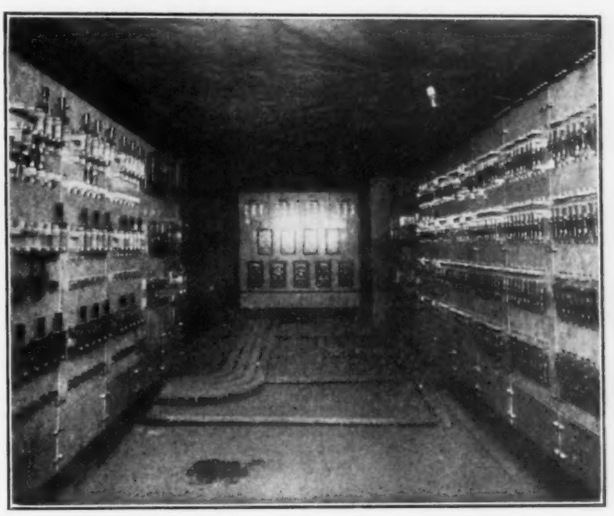


FIG. 7—A VIEW OF THE SWITCHBOARD ROOM WITH RECORDING INSTRUMENTS FOR LIGHT AND MOTOR SERVICE

for the local lighting of furniture and equipment. These boxes are similar in construction to the feeder pull-boxes, but smaller, the upper collar of the flange being drilled for the insertion of outlet nozzles or conduit for the extension of circuits to lighting outlets located on furniture. In the remainder of the building small cast-iron floor boxes are used, fitted with an adjustable screw collar having cast-brass flange cover tapped and fitted with plug.

sizes of cables range from No. 4 to No. 4-0, except the service feeders, which include sizes of 500,000 circ. mils and 1,000,000 circ. mils. The branch lighting circuits from the distribution tablets are made up of twin-conductor, double-braided, rubber-insulated wire, known as 30 per cent "Para," in sizes from No. 14 to No. 10 B. & S. gage.

In order to identify the various circuits and to facilitate future testing work and the installation of lighting fixtures,

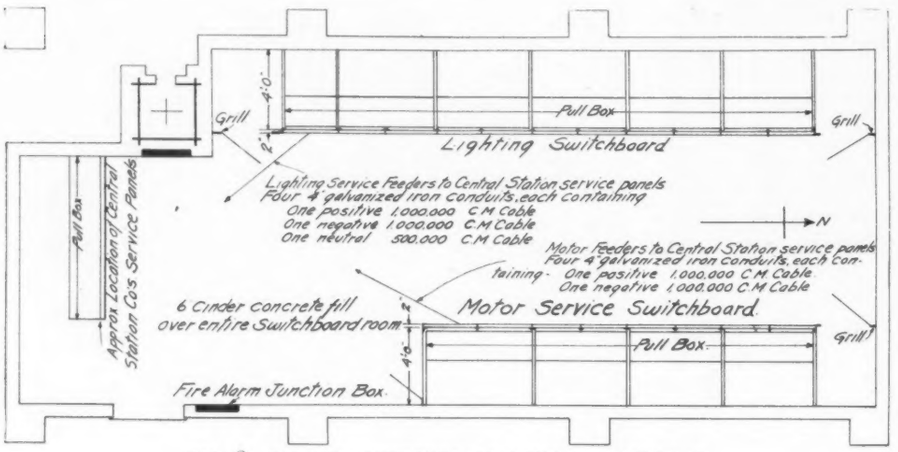

Grill
Pull Box
Lighting Switchboard
Grill
Lighting Service Feeders to Central Station service panels
Four 4" galvanized iron conduits, each containing
One positive 1,000,000 C.M. Cable
One negative 1,000,000 C.M. Cable
One neutral 500,000 C.M. Cable
N
Motor Feeders to Central Station service panels
Four 4" galvanized iron conduits, each containing
One positive 1,000,000 C.M. Cable
One negative 1,000,000 C.M. Cable
Pull Box
Approx. Location of Central Station Co's Service Panels
6" Cinder concrete fill over entire Switchboard room
Motor Service Switchboard
Pull Box
Grill
Fire Alarm Junction Box

FIG. 8—PLAN OF SWITCHBOARD ROOM IN BASEMENT

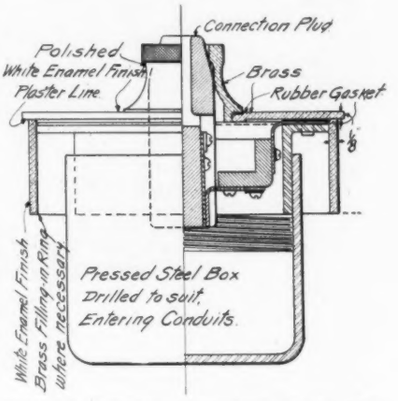


FIG. 11—DETAIL OF PLUG WALL RECEPTACLE FOR LOCAL LIGHTING OF FURNITURE, DESKS, ETC.

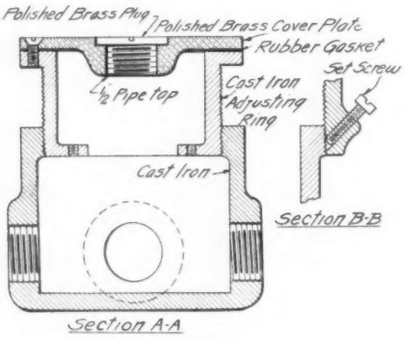


FIG. 9—DETAIL OF SMALL FLOOR OUTLET BOX FOR DESK-LIGHTING, TELEPHONES, CALL BELLS, ETC.

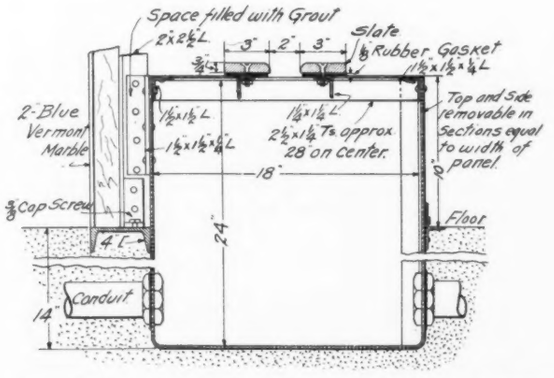


FIG. 12—DETAIL OF FEEDER PULL BOX AT REAR OF SWITCHBOARDS

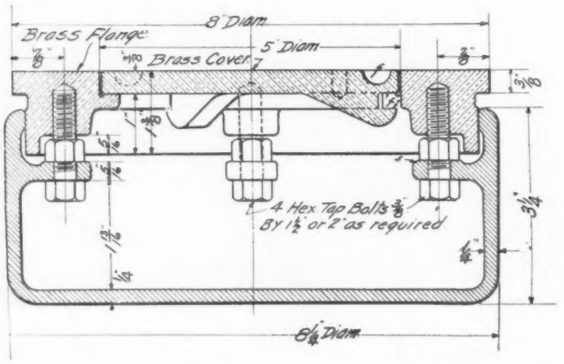


FIG. 10—DETAIL OF SPECIAL LARGE, WATER-TIGHT, ADJUSTABLE FLOOR OUTLET BOX USED IN GENERAL WORKROOM ON FIRST FLOOR, FOR LOCAL LIGHTING OF FURNITURE AND MAIL-HANDLING EQUIPMENT

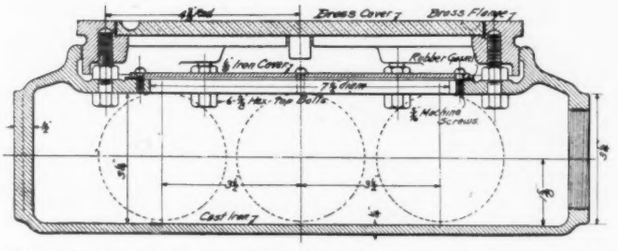


FIG. 13—DETAIL OF WATERPROOF-FLOOR PULL BOX FOR MOTOR AND LIGHTING FEEDERS

The floor outlets are in every case located to suit the furniture layouts, with a view to inserting the conduit in the top of the box to protect the wires extending up the side of desks, tables, etc.

Cables.—All service and distribution feeder cables are varnished-cambric-insulated conductors, triple-conductor cables being used for three-wire lighting distribution and single-conductor cables being used for motor circuits. The

the wire at each outlet is provided with a small cardboard tag on which is marked the tablet and switch number to which the wire is connected. In addition diagrams are provided in each tablet to indicate the arrangement and control of circuits.

Changing Over Temporary Work.—As a portion of this building was completed and occupied before the contracts for the entire building were awarded, it was necessary to

supply a complete wiring system with a switchboard in this so-called "temporary portion." This requirement necessitated the location of a temporary switchboard in the position to be occupied by the permanent switchboard room and the placing of outgoing conduits across the exposed basement floor slab of the uncompleted portion of the building. All the cables which were to be used in the permanent installation were made of sufficient length for the final connections and the excess of cable was coiled and carried on a rack at the back of the temporary board.

SCHEME OF ILLUMINATION

The lighting of the new post office building is carried out in the main by general illumination, reinforced where required by local lighting. Direct lighting by tungsten lamps is used throughout. The lamps are housed in reflectors which serve to direct the light to the working spaces.

Some of the executive offices, one of the corridors and the stairways are lighted by means of lamps on wall brackets, but with these exceptions the illumination is derived from lighting units at or suspended from the ceiling. Wall receptacles for attachment of portable lamps are liberally provided, and in some of the larger working spaces floor outlets for the same purpose are installed. Previous to the preparation of lighting plans, accurate layouts were provided, showing the position of furniture in each of the various departments throughout the building. In offices and workrooms a scheme of general illumination was adopted, but in locker rooms, record rooms, storage rooms, etc., which occupy considerable space in the building, the lighting outlets were located over the center of aisles or to meet the local requirements. This layout for local lighting was particularly difficult because of the design of the steel framing in the building, which in many

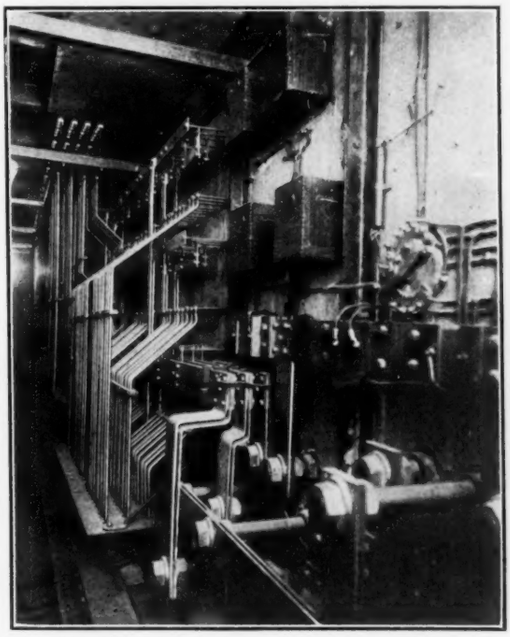


FIG. 14—REAR VIEW OF LIGHTING SWITCHBOARD SHOWING BUSBAR WORK AND VERTICAL COPPER RODS CONNECTING LIGHTING FEEDERS

cases prevented the location of outlets at the desired places.

As an example of the special local lighting requirements for the building, it was necessary to place outlets for fixtures over the "dummy car racks" in the railway mail service division to reproduce the lighting scheme which had previously been adopted for the same layout of racks in the mail cars, as the operators sort the mail at the "dummy racks" previous to the departure of the trains and continue their work in the cars.

To secure a practically uniform distribution of light over the large circular separation jugs and to avoid objectionable shadows the exact location of outlets for these jugs had to be determined in advance. The illustration shows the arrangement of the outlets and lighting fixtures for

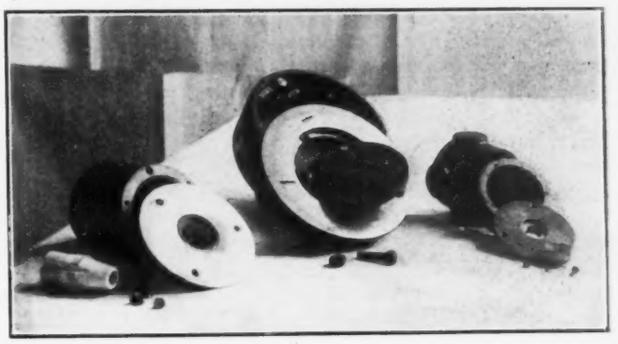


FIG. 15—SPECIAL PLUG RECEPTACLE AND FLOOR JUNCTION BOX

securing uniform illumination both in front and in the rear of the jugs. With this design the mail sorter is provided with good lighting in every working position.

The building contains an examination room in which employees are subjected to a practical test with reference to their fitness for sorting and routing the mail. This test involves the actual performance of the specific work the employee is called upon to perform, and it takes cognizance of both speed and accuracy. The lighting layout of this room is therefore designed to reproduce exactly the lighting system designed for the same class of work in the postal service.

Special provision was made to secure flexibility for the lighting under the huge skylight for the general workroom on the first floor. This flexibility was secured by providing a total of 108 ceiling outlets, evenly distributed, and connecting these outlets by conduit with six separate tap circuits extending the entire length of each group of six outlets. This arrangement permits of separate or of group control of the outlets. As the skylight in which these outlets are located is inclined with varying pitches, special outlet boxes were designed for each case to permit the fixture studs to hang plumb. A general view of this skylight is shown in the illustration.

LIGHTING FIXTURES

In accordance with the practice usually followed by the United States Treasury Department, which has control over the mechanical, electrical and illuminating equipment of federal buildings, the lighting fixtures are provided under the appropriation for "furniture and repairs of same for public buildings." The practice of the department is to design the lighting fixtures even in the case of buildings constructed by independent architects, no fee being allowed for this purpose, though in the case of this post office building the architects submitted designs for several of the decorative fixtures. The lighting fixtures thus far installed follow the conventional Post Office Department designs, types of which are shown in Figs. 17, 19, 20 and 21, for fixtures installed in the portion of the building now occupied.

The street lamp-posts are similar to those designed by the same architects for the Pennsylvania Railroad Terminal on the opposite side of the avenue. The type of post, glassware, size of lamp, height above the street level and spacing were approved by the Department of Water Supply, Gas and Electricity of the city of New York. The ten posts on Eighth Avenue between Thirty-first and Thirty-third Streets will be equipped with 400-watt tungsten lamps spaced from

46 ft. to 48 ft. apart. The twenty posts on the north and south sides of the building will carry 250-watt lamps. The posts will stand 20 ft. over all. The lamps are so mounted that the bottom of the filament is in the horizontal plane passing through the center of the glazed portion of the lantern.

An extended series of tests was made with different types of diffusing glassware to ascertain the most desirable lighting result, intensity of illumination, low intrinsic brightness and absence of sharp shadows being three important considerations. A crystal glass flashed with opal on one side was found to meet the requirements in the best manner of all the glassware tried.

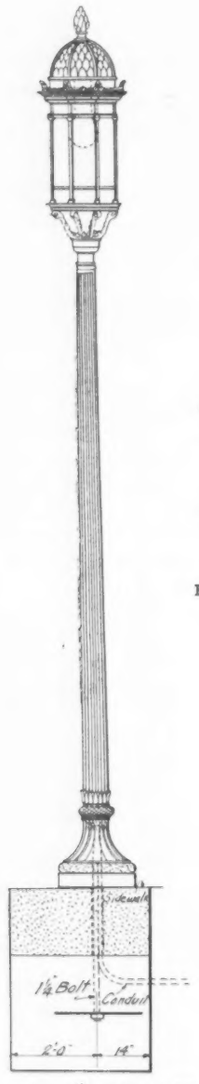


FIG. 16—POST FOR STREET LIGHTING

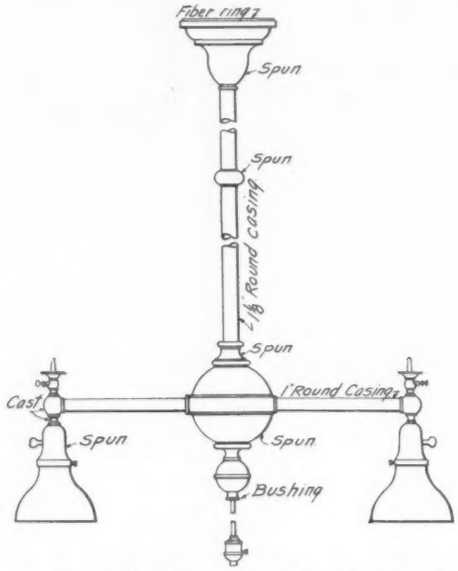
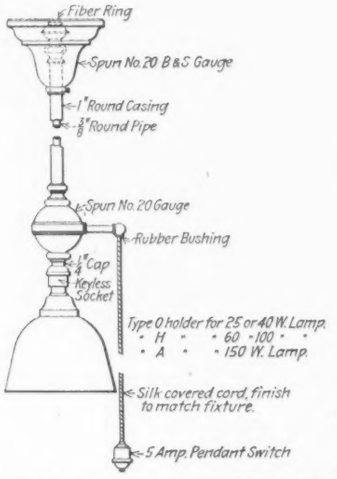


FIG. 17—TWO-LAMP COMBINATION GAS AND ELECTRIC FIXTURE NO. 502, FOR WORKROOMS


Fiber Ring
Spun No. 20 B & S Gauge
1" Round Casing
⅜" Round Pipe
Spun No. 20 Gauge
Rubber Bushing
1¼" Cap
Keyless Socket
Type O holder for 25 or 40 W. Lamp.
" H " " 60 " 100 " "
" A " " 150 W. Lamp.
Silk covered cord, finish to match fixture.
5 Amp. Pendant Switch

Insulating Ring
Spun
No. 8-32 Screw
⅛" Pipe
⅜" Casing
Special ⅛" Cap
Keyless Socket
Type O holder for 25 or 40 W. Lamp.
" H " " 60 " 100 " "
" A " " 150 W. Lamp.

FIGS. 19 AND 20—DETAILS OF LIGHTING FIXTURES NOS. 602 AND 603

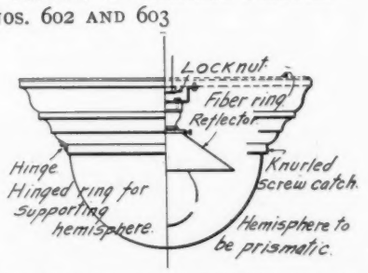


FIG. 21—LIGHTING FIXTURE NO. 520, FOR LOW CEILINGS IN CORRIDORS AND ELEVATOR ENTRANCE HALLS

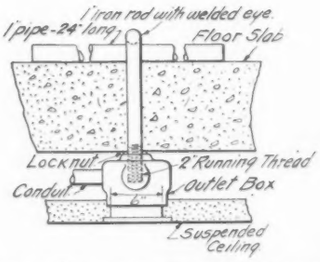


FIG. 18—DETAIL OF SPECIAL OUTLET BOX AND FIXTURE SUPPORT FOR SUSPENDED CEILINGS IN PUBLIC CORRIDORS

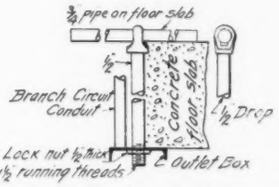


FIG. 22—DETAIL OF CEILING OUTLET AND LIGHTING-FIXTURE SUPPORT

Miscellaneous Conduit Systems

In addition to the electric lighting and motor circuits which have been described, conduit systems have been provided to accommodate the future installation of telephones, clocks, fire alarms, vault protection, call-bell systems, etc. Provision has been made for the various service companies to bring their conduit and wiring into the building under the main steps on the Eighth Avenue side, where the main junction boxes for telephone and telegraph service are installed.

From the telephone junction box the main line feeder conduit is carried directly to the telephone switchboard room, terminating in a large floor box, approximately 15 ft. in length. The circuit, after passing through switchboards (to be installed), will then continue through a system of conduits carried in the floor construction to the various telephone outlets in the building. The floor outlet boxes for telephones are similar to those used for lighting service and are located to meet the furniture layouts of the Post Office Department.

The clock conduit system contemplates the installation of either electric or pneumatically operated systems. The master clock and relay box are located in the assistant custodian's room on the second floor of the building. From the relay box the conduits are run to the various portions of the building where secondary clocks are to be located. The arrangement of conduits provides for not more than twelve clock outlets to be placed on any one circuit. In connection with this system there will be provided a program clock installed in the first-floor workroom by which the various signal bells used in controlling mail movements can be automatically operated. The program bell conduits will be cross-connected with the general clock system. The master clock will be regulated by direct-wire service connection with standard Washington time.

Each of the eight fireproof vaults is to be provided with an electric protective system, connected with external circuits, the service feeders being carried to the assistant

custodian's room, in which will be located the various indicating devices. From this point the conduits extend to each of the several vaults. In order to avoid having live electric wires within the closed vaults, the lighting circuit is arranged as follows: A plug receptacle is located on the outside of each vault door near the lock side of the door and a similar receptacle in a corresponding position on

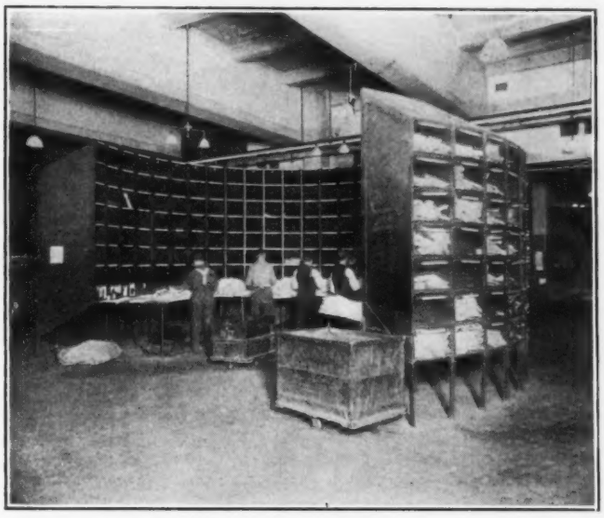


FIG. 23—VIEW OF ONE OF THE NEW-TYPE STEEL NEWSPAPER-SEPARATING JUGS IN BASEMENT, SHOWING ARRANGEMENT OF THE LIGHTING FIXTURES EQUIPPED WITH PRISMATIC REFLECTORS AND 100-WATT BOWL-FROSTED TUNGSTEN LAMPS

the inside of the vault. The inner receptacle is connected by conduit and wire to the lighting outlets in the roof of the vault. To secure light within the vault the two receptacles are connected by a "jumper" or extension cord.

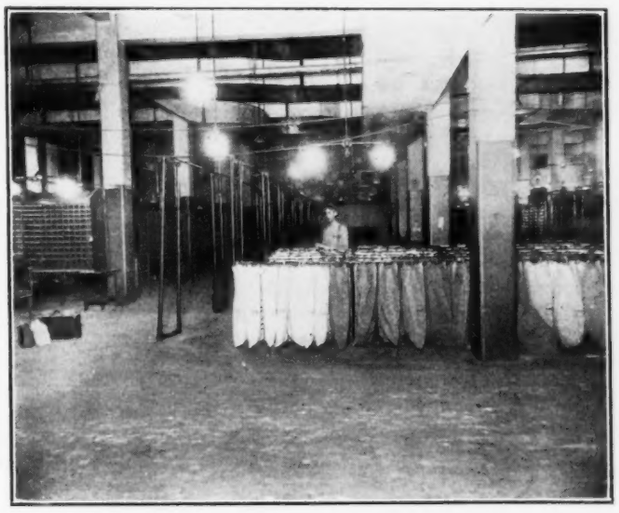


FIG. 24—VIEW OF RAILWAY MAIL SERVICE DIVISION IN THE BASEMENT SHOWING POUCH-RACK DISTRIBUTION CASES AND LIGHTING FIXTURES ARRANGED AS IN MAIL CARS; 100-WATT BOWL-FROSTED TUNGSTEN LAMPS BACKED BY PRISMATIC REFLECTORS

To close the vault doors the extension cord must be removed, thus removing any possible fire hazard due to live wires.

A conduit system is also installed for call bells and annunciators connecting the various offices, provision being made for installing buzzers on individual desks or bells on walls as may be required. These call-bell systems will be installed at the time the office furniture is placed in position.

It is important that the United States Post Office railway and mail service divisions, which have quarters in this building, be kept informed regarding the arrival and dispatch of trains operated by the Pennsylvania Railroad Company. For this purpose the railroad company has already installed a tele-autograph apparatus connected with the yardmaster's office, from which records of the train service are dispatched directly into the post office and automatically written by the tele-autograph in plain view of the Post Office employees. This system is to be extended into the general workroom of the post office. Provision has also been made for the installation of a marine ticker, whereby full information will be furnished to the post office regarding the sailings and arrivals of the steamships of the various companies in New York Harbor.

A complete system of conduit is provided for fire-alarm signals, which will be connected with the New York City

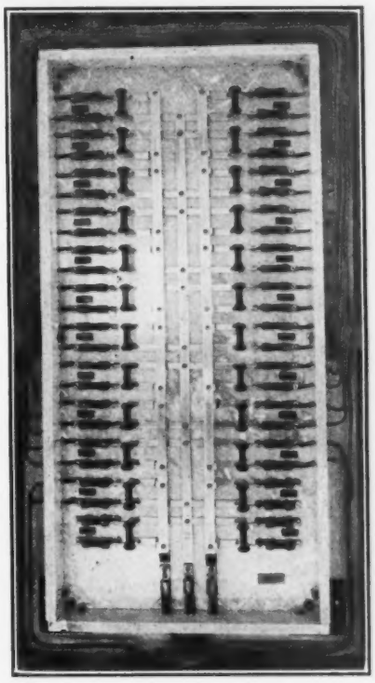


FIG. 25—THE INTERIOR OF ONE OF THE SEVENTY-THREE THREE-WIRE LIGHTING DISTRIBUTION TABLETS OF BLUE VERMONT MARBLE MOUNTED IN ONE-PIECE STEEL BOX WITH ADJUSTABLE LUGS FOR ATTACHMENT OF CAST-IRON OR STEEL FRONTS

fire department system. The main service lines entering the building are carried directly to an indicator box in the electric switchboard room, and from this point the conduit encircles the basement and is connected by means of risers to a similar conduit encircling the super-attic of the building. The alarm boxes are located in the various corridors and in the larger workrooms throughout the building. Directly over each alarm box an alarm gong outlet is placed. A fire alarm rung at any point will cause all gongs on the system to ring and will indicate, in the switchboard room in the basement of the building, the location of the box at which the alarm was sent, besides transmitting the signal to the city fire department.

For the purpose of identifying the various outlets and pull-boxes on the several conduit systems, the interiors of these boxes have been painted in different colors as follows: Telephone outlets, blue; clock outlets, green; call-bell outlets, yellow; vault-protection outlets, white; fire-alarm outlets, red; telegraph outlets, brown. As a further means of identification, the covers of the pull-boxes are to be stamped with letters indicating the service.

Electric Fuse Testing

By A. A. Somerville

In a recent set of experiments the author had opportunity to observe and consider the advantages and disadvantages of the electric fuse, as used at present. During this investigation several new points were brought out.

Since a fuse is a conductor of such proportions that it will melt when the current in the circuit exceeds a certain prearranged value and thus protect the remainder of the circuit from the harm that would result from undue overload, it will be appreciated that its construction may be varied quite widely. Patents have been granted on such features as the composition of fuse metals, shape of fuse wires or strips, calibration of strips, insulating material surrounding the strips, mounting of fuses and chemical effects of oxides and fluxes, and the state of the art is rather complicated, thereby tending to promote involved litigation in patent causes. The operation of fuses has been in many ways unsatisfactory; the current at which they would blow has always been indefinite and liable to change with the age of the fuse. Generally the carrying capacity of the fuse increases with time, because repeated annealing renders the fuse metal a better conductor. However, the repeated heating and cooling may loosen some of the contacts, thereby making a high-contact resistance which will become unduly heated and thus cause the fuse to blow even when the current is below the normal value. In spite of their faults fuses are invaluable for the protection of small circuits where the cost of circuit-breakers would be prohibitive. Most wiring rules require that fuses be used on every pole where a reduction in size of wire takes place and in each branch where a tap is made off a main line.

Each particular type of fuse has its own place, and care must be taken that the type designed for each class of work is used for that work and that only. For instance, the small piece of copper wire connecting two terminals is the most dangerous fuse that can be used for ordinary work, but the fact remains that it is used frequently for temporary repairs. The same kind of copper wire several feet in length is found to be the safest fuse obtainable for a high-tension transmission line and is used in such work. Unless the wire is long the arc will persist under high voltage and cause damage. The long wire exposed to the air or slightly covered will safely carry the normal load, and when fused it drops away entirely, thereby opening up a long gap and effectually breaking the arc that is started.

Cartridge fuses differ from the preceding in that the fuse metal is surrounded by a tube of insulating material, and this tube is fitted with metal caps to slip into terminal receptacles of the holder. The fuse wire is soldered or riveted to these metal caps. It is this class of fuse that is now almost universally used on small lighting and motor circuits, and it was upon these that a thorough test was made by the author. After a series of exhaustive tests it was decided that almost any kind of wire may be used as a fuse. The fusing current of the wire depends not only on the metal of which it is composed, but also upon its surroundings, the state of its surface and other factors. It is claimed that in time some metals become coated with an oxide and that this holds the metal in place like a protective tube or sheath even after the metal is melted. It was to determine the effect, if any, of this film of oxide on the fuse metal that the following experiment was attempted.

The Underwriters' National Electric Association has made very definite rules for the construction of fuses. At a voltage of from 0 to 250, lines carrying from 61 amp to 100 amp form a class in which a fuse of certain dimensions must be used. For instance, a cartridge fuse having knife-blade contacts and carrying 90 amp at a voltage of from 0 to 250 must be 5⅞ in. over all in length. The distance between contact clips must be 4 in., the width of contact clips ⅞ in., the thickness of blades ⅛ in., diameter of tube 1 in., length of blades 1 in. and width of blades ¾ in. The fuse cartridge must be sufficiently dust-tight so that lint and dust cannot collect around the fuse wire and become ignited when the fuse is blown. The fusible wire must be attached to the cartridge in such a way that a thoroughly good connection is secured and so as to make it difficult for it to be refilled when melted. It must be classified so as to correspond with the different classes of cut-out blocks and so designed that it is impossible to put a fuse of one class into a cut-out block which is designed to carry any current for which a fuse of a higher class would be required.

The fuses must be so constructed that with the surrounding atmosphere at a temperature of 74 deg. Fahr. they will carry indefinitely a current 10 per cent greater than that at which they are rated, and at a current 25 per cent greater than the normal rating they will open the circuit without doing injury to the fuse tube or terminals. With a current 50 per cent greater than the rating and at a room temperature of 75 deg., they must, starting cold, blow in two minutes. The temperature of the exterior of the fuse must not rise more than 125 deg. Fahr. above that of the surrounding air when the fuse is carrying the current for which it is rated. It must not hold an arc or throw out molten metal so as to ignite easily inflammable material on or near the cut-out, when only one fuse is blown at a time, on a short-circuit, at a voltage for which the fuse is designed. It was upon this class of fuses that the tests spoken of were carried out.

Zinc, tin, copper, aluminum and magnesium were the materials examined, and three insulating materials were tried around the fuse wire, namely, manganese dioxide, slaked lime and borax. From the observation made the following conclusions were drawn: Any metal may be used as a fuse strip, and if conditions are properly adjusted the fuse will blow at a fairly definite overload and make a sharp, clean break in the circuit. The factors that produce ideal conditions differ with the various metals, but the controlling features are relative values of length, width and thickness of the strip, together with the amount and kind of insulating powder surrounding it.

All metals make equally clean breaks when properly adjusted. However, it is slightly easier to work with the metals having the lower melting points, as the thermal insulation is not such an important feature.

The character of the insulating powders used around the fuse wire is without effect except in a thermal way, and the rate at which the powders radiate heat from the fuse wire determines its capacity. The chemical effect, if any, on the fuse wire is negligible.

The load or current that a fuse will carry depends upon the melting point of the metal used, the cross-section, shape and length of the conductor, size of the terminal plugs and contents of the casing, should there be any, surrounding the fuse metal.

The carrying capacity of a fuse varies with the cross-sectional area and inversely as the length, on account of the variation in temperature gradient in the fuse. The carrying capacity increases directly as the size of the copper terminals, since they conduct the heat away; directly as the increase in melting point of one material over another, and as a function of the thermal conducting power of the powdered material surrounding the fuse metal.

Lastly, fuses at their best are very unreliable and no two fuses except by chance will operate in the same way. If a dozen fuses supposed to be alike are blown under the same conditions, the deviation in time required to blow will usually be 25 per cent of the average. It may be said that the unreliability of the fuse with respect to the time-limit specification is its chief bad feature. Although the advance made in the manufacture of fuses has been very marked recently, there is yet ample room for improvement.

Wireless-Telegraph Station at Fort Myer, Va.

By D. H. TUCK AND M. B. HODGSON

Until recently the United States and Italy were the only ones among the important nations that had not installed government coastal wireless-telegraphy stations for communicating with the merchant marine. Although a number

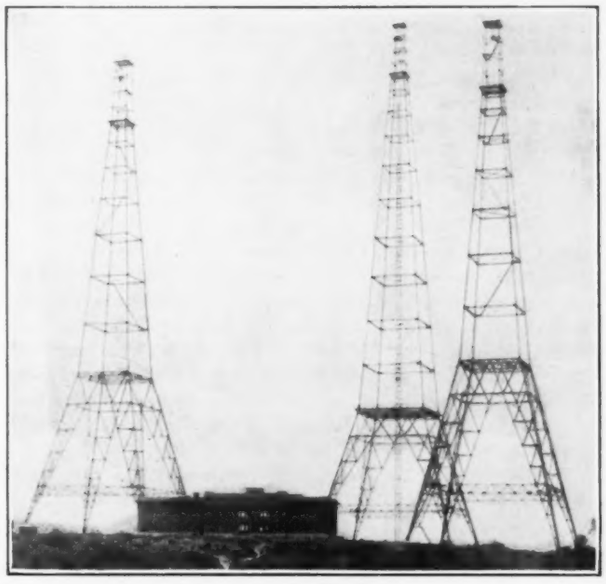


FIG. 1—WIRELESS STATION, FORT MYER

of private commercial stations had been established in this country, these, being operated with the idea of business gain, served merely as news channels for incoming and outgoing steamers and rarely performed the functions of a distributer of general items such as storm warnings, etc., except by special contract. Owing to commercial jealousy, little was attempted along co-operative lines, each company using its own system and being free to transmit and receive as it pleased. The few stations operated by the federal government confined themselves strictly to military and naval uses.

It was to meet this lack of co-operation that the United States government, through the Navy Department, installed the new wireless-telegraph station at Fort Myer, Va. While primarily a distributing center for naval orders, the equipment and facilities of an experimental station have been included, thus, with the practical working equipment, making the station valuable as a laboratory for developing and testing new apparatus. With the coastal stations, the Fort Myer plant will also form a bulletin-distributing bureau. At a prearranged time each day news bulletins will be sent out, giving the bearings of ships, derelicts and icebergs reported, together with storm warnings, etc. Individual reports of maritime interest will also be received and transmitted.

The new station is situated just outside the city of Washington, D. C., among the Virginia hills, 150 ft. above sea level. The entire plant, comprising the laboratory and three great towers, occupies a federal reservation of about five acres. It was designed and built under the supervision of the Bureau of Yards and Docks of the Navy Department, the Baltimore Bridge Company having obtained the contract for erecting the three towers and the National Electric Signaling Company, Pittsburgh, Pa., supplying special apparatus.

The three towers are located at the angles of an isosceles triangle, the two smaller 450-ft. towers being identical, 125 ft. square at the base and tapering to 15 ft. square at the top. The main 600-ft. tower is 150 ft. square at the base and tapers to 15 ft. square at the top. All three are of the same general type of construction, being built up of box girders whose angles are of ½-in. steel reinforced with ⅜-in. plates. The platforms at the top are reached by zigzag ladders arranged with convenient landings. Each of the four uprights of the towers is embedded in a mass of concrete 10 ft. square and reaching into the earth a distance of 12 ft. to a sub-foundation composed of rock and clay.

The entire structures are insulated from the ground by marble washers waterproofed with varnish. One of these pedestals is shown in Fig. 2. The precaution of insulating the bases was taken since there seemed to be no reliable data concerning the possible effects on signaling devices of large electrical capacities like those of the towers. The towers are, however, connected by ground wires and disconnecting switches, so that experimental data of this kind may be obtained in the future.

The building in connection with the station was designed to meet the requirements of a modern radio-telegraph plant including well-equipped research and testing laboratories. Space has also been included for a machine shop and for dormitories for the employees. On the first floor, occupying a space of about 2400 sq. ft., is the generating room. At present 25-cycle, 6600-volt, three-phase electrical energy, supplied by a local central-station company, is stepped down to 220 volts to operate a 200 hp Westinghouse synchronous motor running at 500 r.p.m. and belt-connected to a 220-volt, 500-cycle Westinghouse alternator which operates at 1250 r.p.m. The motor is separately excited by a General Electric direct-current generator, which is also used as a source of energy for auxiliary apparatus.

The output of the high-frequency alternator is for transmitting purposes stepped up to a working pressure of 25,000 volts. The revolving spark-gap employed consists of a 4-ft. wheel whose fifty terminals, corresponding to the fifty poles of the generator, give 1000 discharges per second. The pole spokes are of ½-in. copper, 8 in. in length. Because of the high centrifugal forces which the fastenings must withstand, life and apparatus in the vicinity are safe-

FIG. 2—ONE OF THE TOWER PEDESTALS

guarded against possible flying spokes by a 12-in. beam in the plane of the wheel. The minimum spark-gap is 1/64-in., but owing to the high potential the air breaks down about 3 in. ahead of and behind the small gap discharge. A constant electrostatic capacity is provided, consisting of a bank of nine condensers in parallel, each having a rating of 0.036 mf. These condensers are made up of steel plates

set in steel cylinders and all air-insulated at a pressure of 300 lb. per square inch. The wave transmitted can be varied by means of three variable inductance units. These inductances, together with the condensers, are the ones formerly used by the Fessenden station at Brant Rock, Mass. The signaling contacts are manipulated from the operating room by relays, a variable resistance of 220 ohms

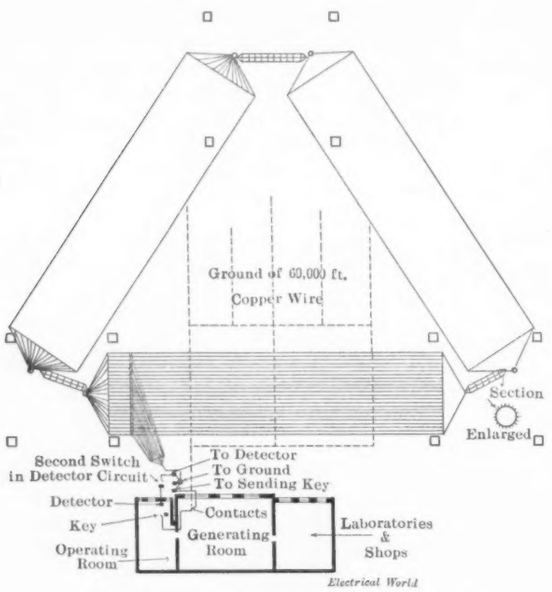


FIG. 3—PLAN OF STATION AND CIRCUITS

being shunted across the contact points on the low-voltage side to prevent excessive arcing at the contacts. The ground wires, which are led out through the basement, terminate in 60,000 ft. of bare copper wire laid in trenches between the towers. The sending wires connecting to the aerials are led out through a heavily insulated window pane, 1 in. thick, to the distributing pole, which is shown in Fig. 5.

At this ingenious device terminate the wires from the generator, controlled by the sending key, the line to the detector, and a third wire which is well grounded. The transmitting and detector wires are extra-insulated from their wire supports by composition strain insulators and from the posts by large double-petticoat porcelain insulators. The terminals of these three wires form the contacts of a three-point switch controlled from the operating

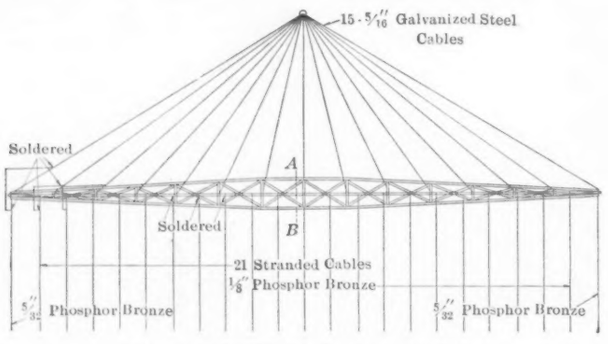


FIG. 4.—CONSTRUCTION OF AERIALS

room by a system of chains and pulleys. The movable switch arm leads to the aerial wires. A double-throw, single-pole switch is placed in the detector side of the line. With this switch arrangement it is evident that the operator can at will close the circuit for receiving messages, change over for sending, or ground the entire system, as in time of storms.

The wires are run to the aerial spreaders as shown in Fig. 4. These spreaders are built of 2.5-in. galvanized-iron pipe, reinforced with 3/8-in. strapping of galvanized steel. They measure 88 ft. in length and are square in section, increasing to 3 ft. at the widest part. The weight of spreaders and wires is supported by a bridle of 15 5/16-in. galvanized-steel cables, connected to the pipe by turnbuckles and terminating at the top in a 10-in. steel ring. The aerial wires proper, comprising twenty-three phosphor-bronze stranded cables, 1/8-in. diameter, are soldered both to the iron pipe and to the bridle. These bridles are supported and insulated from the trusses at the top of the towers by ten 10-in. buck links.

The connections between aerials are made by "cages," each cage containing twenty-three phosphor-bronze wires soldered to the bridles of the spreaders. Connections, therefore, are not dependent at any point on one strand or cable. The wires between the 600-ft. main tower and the two 450-ft. towers are about 400 ft. in length, and those between the two smaller towers 300 ft. Forty feet is allowed in each span for sag. From needle-point tests, which showed a spark-length of 11 in., it has been estimated that a potential of 150,000 volts is obtained at the topmost point of the antennas. A cloth sack blown from the top of one of the towers landed on an aerial and instantly burst into flame.

When complete the generating room will also include an

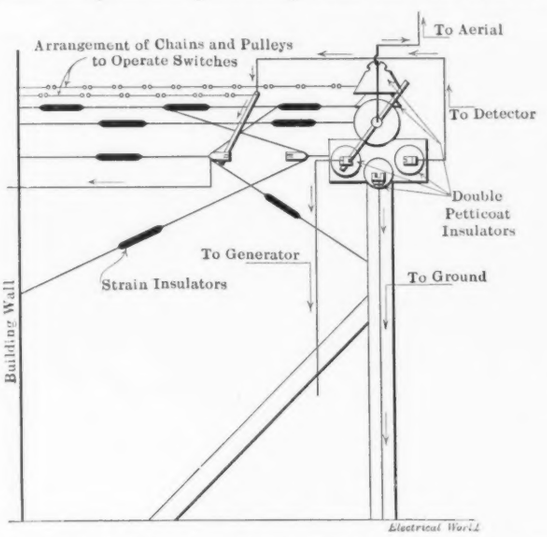


FIG. 5—ARRANGEMENT OF SWITCHES ON DISTRIBUTING POLE

internal-combustion-engine isolated plant. When this source of energy is installed it is hoped to do away with the somewhat elaborate spark-controlling system now used. Several small motor-generator sets will also be available for the lighting and storage-battery systems, and for furnishing 25-cycle, 40-cycle and 60-cycle energy for experimental purposes. From the storage battery emfs of from 1 volt to 250 volts will be available. Provision has also been made in this building for testing complete generating sets for government stations.

Up to the present time the twin Marconi stations at Glace Bay, Canada, and Clifden, Ireland, have represented the highest development in the wireless field. These two stations, with towers 450 ft. high, have intercommunicated for some time. There is also a German station at Nauen with a 450-ft. mast.

Officials of the new Fort Myer station hope to obtain, when working at full range, a maximum distance of 3000 to 4000 miles. Already communication has been established with the Marconi station at Glace Bay and with the naval station at Key West, Fla., and time signals have been picked up from the station established in the Eiffel Tower at Paris, France.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Delivering Coal with Electric Trucks

Coal companies in the larger cities are increasing and repeating their orders for electric trucks for delivery purposes, for the experience of the past with these battery-driven wagons has proved them cheaper and far more reliable than gasoline cars or any animal motive power. Coal deliveries are mostly city runs and hence fall within the approved province of the electric vehicle. The weather conditions of snow, ice and sleet are likely to be at their worst when coal delivery service is most needed, so the electric truck again scores with its superior dependability despite any weather.

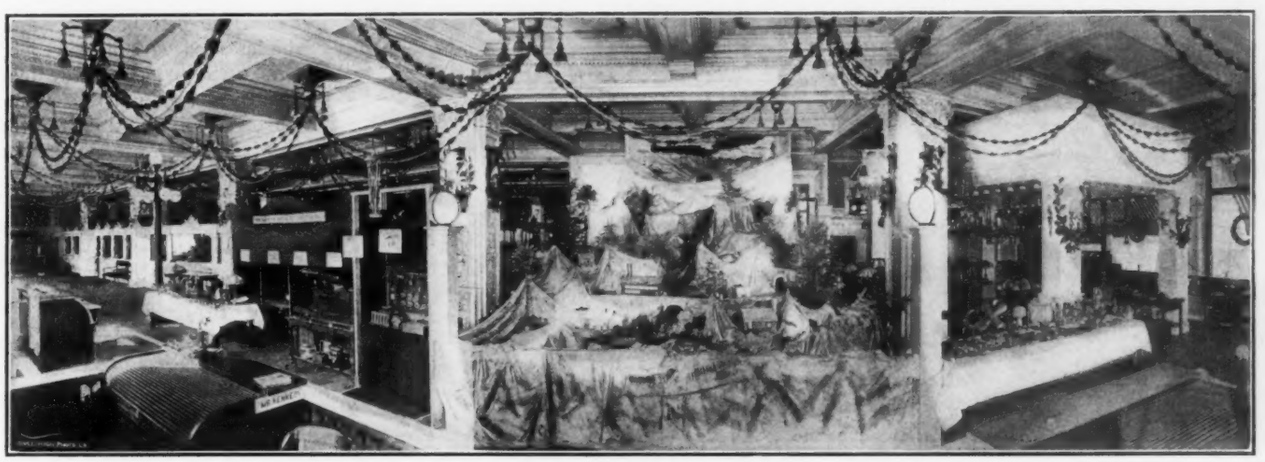
One coal company which, according to the monthly vehicle publication of the Denver Gas & Electric Company, has had exceptional opportunity for studying its electric delivery service employs a car which hauled 435 tons of coal in one month. This was a daily average of 365,624 lb., or 18.3 tons. The largest number of pounds of coal hauled in a single day by the truck amounted to 44,300 lb., the equivalent of 22.1 tons. It covered 63 miles in a day and the record number of trips was seven. The truck was in service 229 hours, but it was engaged in hauling only 126 hours, 103 hours being required to load and unload it. The total mileage for the machine for the whole month was 1005 miles. It took 119 trips, averaging 8½ miles each, to accomplish that distance.

Union Electric Bulletin a 1913 Youngster

Dated January, 1913, the first number of the *Union Electric Bulletin* has made its appearance. This is a magazine published by the Union Electric Light & Power Company Section of the National Electric Light Association in St. Louis. The first issue contains an interesting budget of news and gossip relating to company affairs. Mr. A. C. Einstein, the vice-president of the company, contributes the foreword in the shape of a New Year's greeting. Possibly the most important article is an outline of the plans of the new Employees' Mutual Benefit Association of the company. The object of this association is to furnish to its members mutual aid and assistance in case of sickness, accident or death. It is to be conducted for the sole benefit of its members and not for profit. The *Bulletin* will be published monthly and is edited by Mr. L. C. Davis, publicity agent of the sales department, who, among other things, contributed to the first issue an original poem entitled "When Franklin Flew His Kite." Mr. Edison sent a letter saying that he was in sympathy with the object of the publication.

Spectacular Central-Station Exhibit in Denver

Following its industrial exhibit, described and illustrated in the *Electrical World* of Dec. 21, page 1321, the Denver Gas & Electric Light Company made an exhibit of a more spectacular nature during the recent holiday season. The display was installed in the company's headquarters building at 900 Fifteenth Street, and the accompanying illustration is a reproduction of a panoramic photograph. The exhibit was very successful and aroused a great deal of interest in Denver and nearby cities and towns. All classes of people came in to see it. Although a conspicuous popular attraction, scientific men and engineers did not disdain to witness and explain the various experiments carried out. There were a singing arc, a 1,000,000-volt Tesla coil and a "wireless" electric lamp which was lighted in a bowl of water. The climbing arc also proved of interest. This was built for wireless purposes, and the transformer used was wound for 20,000 volts secondary. An X-ray machine was one of the attractions and resulted in the sale of a similar machine to a local physician. Indeed, while the primary object of the exhibit was to foster the flat-rate propositions and window and sign-lighting activities of the company, it is felt that the show has had a beneficial effect in several other directions.



PANORAMA OF DENVER CENTRAL-STATION EXHIBIT

One of the conspicuous features of the display was the mountain scene in miniature shown in the middle of the accompanying picture. This model represents the vicinity of James Peak and the proposed Moffat Tunnel. It was quite true to life and proved a popular attraction. A

waterfall formed a realistic feature of the hydroelectric equipment in the "mountains," and many of the visitors could not understand where the water came from. A concealed tank was provided, and by means of an electrically driven pump the same water was used continuously. At the right of the picture is shown a booth in which was exhibited an excellent collection of artistic lighting fixtures, lamps and shades.

A Practical Farmer in Praise of Electricity

Mr. W. H. Brown, manager of the Red River Power Company of Grand Forks, N. D., received a letter recently from Mr. J. D. Bacon, a farmer residing near Grand Forks, who uses electrical energy on his farm. Mr. Bacon wrote: "In answer to your question regarding electric energy on the farm, I will say that we hardly know how to get along without it since becoming used to such a convenience. For threshing and ensilage cutting we are so much better pleased with it than with gasoline or steam that it is hard to compare them, and, besides the great convenience, the expense is considerably less than with either of the others. If farmers in general could realize what a snap it is to have power that can be used simply by turning it on, no matter what the weather is, they would certainly begin to co-operate with one another and have lines put in."

Central-Station Growth at Salt Lake City

Records kept by the commercial department of the Utah Light & Railway Company of Salt Lake City show that 1500 new houses have been built and connected to the company's lines during the year just closed. In addition about 100 vacant houses have been connected during the year, making a total increase of about 1600 customers during 1912. This growth represents nearly 10 per cent increase in the number of residence customers.

During November, 1912, the Salt Lake company tested 1610 customers' meters with the following results: Meters fast, 31, or 1.9 per cent; meters slow, 76, or 4.7 per cent; meters correct, 1503, or 93.4 per cent. These results correspond closely with the results which had been reported in Salt Lake City for previous months.

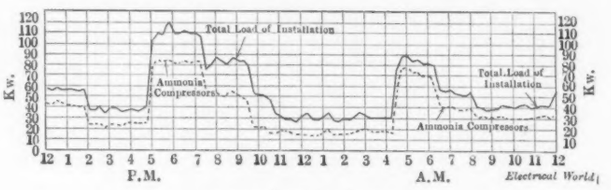
Analysis of Costs in a Refrigerating Plant

In the following paragraphs are given the results of a cost analysis of the refrigerating plant serving a large skating-rink establishment, together with suggestions as to the relative economy of steam and electric operation and possible betterments. The installation provides two ice surfaces for public use, one of 22,000 sq. ft. for skating and one of 5700 sq. ft. for curling. The rink floors are covered with 1.25-in. iron pipe, laid 4.75 in. apart, center to center, and embedded in gravel to the tops of the pipes. The latter are connected to headers which run along each side of the rink. Cold brine is circulated through the pipes, and the latter are divided into sections of eight each, to permit easy disconnection and repairs. There is 55,860 linear ft. of pipe in the larger rink and 13,707 ft. in the curling rink. The ice surface is built up by spraying the pipes with water, the ice being kept at a thickness of from 1.5 in. to 2 in. above the pipes.

The refrigerating plant is of the compression type and consists of one 400-hp boiler with feed pump and auxiliaries, two 16-in. by 30-in. by 24-in. single-acting York compressors driven by Corliss cross-compound steam engines, an ammonia condenser, a brine cooler, pumps and tanks. The feed water passes through an exhaust-steam heater of 500-hp capacity, leaving it at 90 deg. C. The compressor engines operate at 125 lb. boiler pressure, exhausting into a vacuum of 22 in. The ammonia condenser consists of eighteen coils of 1.25-in. and 2-in. pipe, twelve pipes high and 19 ft. long, and is supplied from the city mains in conjunction with the water from the surface wells on the premises. This water after leaving the condenser passes through the steam condenser and thence to the sewer, as no cooling tower is provided. The brine cooler is equipped with ten coils of 2-in. and 3-in. pipe 18 ft. long and fourteen pipes high, arranged in two banks, the brine being stored in a 24-ft. by 10-ft. by 8-ft. tank. It is forced through the cooler and floor piping by two Gould triplex double-acting 8½-in. by 10-in. pumps driven through gearing from a line shaft run by an 8-in. by 10-in. horizontal engine. The brine for the curling rink is supplied by a duplex double-acting pump having a capacity of 150 gal. per minute. The steam for heating the building is taken from the boiler through a reducing valve, the indirect system being used, in which air is drawn in over steam coils by a fan run by a 15-hp motor. A similar motor and fan are used to exhaust the vitiated air from the building. The brine in this plant is composed of a solution of calcium chloride and water, having a specific gravity of 1.185. It passes through the floor piping of the rink at a temperature of about 14 deg. Fahr., returning to the tank at about 16 deg. Fahr., after which it is forced by the pumps into the cooler.

Methods of Test

An extensive test was run upon the plant to determine its power requirements. The boiler feed was measured by a calibrated water meter inserted in the bypass of the feed line. The returns from the heating system and the engine condensate were weighed in tanks. Cooling water for the condensers was determined by subtracting from the meter



TOTAL LOAD CURVE

measuring the total water used in the plant the water taken by the boiler plus a constant quantity credited to leakage. The latter was determined by a run made with only the boiler-feed pump working, so that the difference between the main meter and the boiler-feed meter gave the leakage loss. Coal was weighed in the usual manner in barrows, and the power developed by engines and compressors was determined by indicator cards. The power taken by motors and lamps was separately metered.

In order that the engines and compressors might be indicated it was necessary to make eight offset arms. At the beginning of the test great difficulty was encountered by the winding of the indicator strings of the ammonia cylinders around the offset arms. As a platform intervened between the indicator and the offset, it was impossible to clear the cords before taking the cards. To prevent this trouble the end of a long piece of elastic was attached to the cord, the other being fastened to the ceiling at a point directly above the indicator.

The accompanying total load curve was obtained by adding together the power in kilowatts necessary to drive the ammonia cylinders and brine pumps and the electrical input as calculated from the wattmeters, plotting the total in fifteen-minute periods. The total power demand of the installation varied in twenty-four hours from 27 kw to 121 kw.

The cost of operating the plant per day by steam power was determined to be $94.39, itemized as follows: Electricity for lighting and ventilation service, $11.55; water,

$23.85; coal, $24.54; oil and waste, 15 cents; attendance, $16; insurance, 75 cents; depreciation, $9.05; taxes, $2.47; interest, $6.03; total cost per day, $94.39.

The energy consumption for lighting service every twenty-four hours was 135 kw-hr., and for motors driving fans 27.3 kw-hr., the maximum demand being 33.6 kw for these services. The cost of electricity for lighting and ventilation therefore averaged 6.8 cents per kw-hr. There was fired 12,270 lb. of coal every twenty-four hours, at a cost of $4 per ton. The water consumption was 18,377 cu. ft. per day, the boiler using 69 cu. ft. per hour, the leakage being 88.1 cu. ft. and the condensing requirements 607.9 cu. ft. per hour. An allowance of 0.5 per cent per annum was made for insurance, interest being taken at 4 per cent and taxes at $16.40 per $1,000. The investment cost of the plant was $55,000, and the load-factor on a twenty-four-hour run was 50 per cent, the average peak for one hour being 110.8 kw maximum. The instantaneous load-factor was 45.8 per cent, figuring on the extreme peak of 121.1 kw.

Estimated Cost of Electric Drive

A careful study of the plant indicated that it furnished a highly desirable load from the central-station standpoint, provided off-peak rates could be applied. It is estimated that electric service can be installed successfully if a net average rate of about 2 cents per kw-hr. is applied on an off-peak arrangement by which the installation will take only energy for lighting and ventilation from the supply mains during the peak itself.

It was determined that in case electrical operation should be provided a 26-hp steam boiler 42 in. in diameter and 12 ft. long, containing forty-five tubes, would suffice for heating the incoming air. The cost of this boiler was estimated at $386. Steam is supplied for air heating at 3-lb. pressure. Constant-speed motors are required for driving the ammonia compressors, and two 100-hp outfits of the direct-current type, with a speed rating of 575 r.p.m., were determined for this service. Only one of the two compressors is required to keep the surface of the rink frozen, permitting substantially full-load operation of the motor and consequent maintenance of high economy. For driving the brine pumps, whose speed is varied from time to time, a cumulative compound-wound motor of 25 hp was advised.

The following items are used in figuring the investment for electric operation. First is shown the cost of steam equipment not necessary for electric service, and this total, $28,275, gives, when subtracted from the original investment of $55,000, the cost of equipment essential to either plant. To this last is added the cost of equipment for purely electrical operation, or approximately $42,000, which is the total upon which fixed charges must be met in running the plant by electricity. The figures are: Engines and compressors, $18,150; brine pump engine, $700; boiler, $6,000; boiler-feed pump, $425; feed-water heater, $400; dry vacuum pump and steam condenser, $1,600; boiler-room piping, $1,000; total, $28,275. New equipment required with electrical operation: Two compressors, $12,000; two 100-hp motors, $2,084; one compound motor, 25 hp, $417; boiler for heating system, $386; erection of heating boiler, $75; belts and motor installation, $100; portion of old investment retained, $26,725; total investment for electric drive, $41,787.

This is based on the assumption that the full initial cost of the steam equipment not needed with electric driving could be returned, but as a shrinkage is almost inevitable in the sale of second-hand apparatus, an allowance of only 50 per cent of the original cost of steam plant discarded was made. On this assumption there would have to be added to the investment for electric drive about $14,000, which would presumably be lost in the sale of the steam equipment, making a total of about $56,000 upon which fixed charges must be paid. These were taken as 5 per cent interest, 6 per cent depreciation and repairs and 2 per cent insurance and taxes, or a total of 13 per cent. The total overhead expense on this basis of the electrical installation was found to be $7,280 per year, or, roughly, $20 per day. The estimated cost of operation by electricity was as follows per diem: Electrical energy, 1330 kw-hr. at 2 cents net (off-peak), $26.60; coal for heating, $3.31; water, $22.06; oil and waste, 15 cents; labor, $9.23; total, $61.35; fixed charges per day, $20; approximate total cost of electrical operation, $81.35.

The cost of attendance is found to be greatly reduced, as the analysis shows, with the use of electric service. Under steam-operation conditions the plant runs with two shifts, having an engineer and fireman at night and a helper in the daytime, a chief engineer being in charge of the entire plant. The survey indicated, however, that with the electric drive only a chief engineer and helper would be necessary during the daytime, with an electrician at night. It also appeared that the peak load could be shifted to early afternoon with electric driving by freezing on a thick coat of ice after the morning hours and planing it down before the evening opening instead of freezing it again. By driving the compressors hard just before the peak load comes upon the central station the brine may be cooled sufficiently to keep the ice surfaces in good condition until the peak is passed. It appeared that the installation of a cooling tower would be desirable in the plant. The cost of this was estimated at $1,500, and it was figured that the saving in water would pay for the tower within three months, regardless of whether steam or electric drive were used. At the time of the test the engine valves in the compressor units were poorly adjusted. Proper setting of these would improve the economy of the plant under steam-driven conditions, but the survey indicated that the total cost of operation by electricity would probably fall well within that possible by steam.

A New Year's Window Exhibit

The new and the old were appropriately represented in a novel window display exhibited during the first week of 1913 at the offices of the Kentucky Electric Company, Louisville, Ky. The infant "1913" was shown in an old-fashioned hooded cradle rocked by an electric motor. An old-style milk bottle, in contrast with the modern electric milk-warmer, stood near the sleeping youngster. An electric stove was set alongside a coal range, an electric table-lamp was shown with one of the coal-oil variety, and a percolator was contrasted with a battered coffee-pot, while an electric bed-warmer was compared with a sticky hot-water bottle.

Red Lamps Mark Baltimore Fire-Alarm Boxes

A number of the outlying city fire-alarm boxes in Baltimore are now marked by 25-watt tungsten lamps inclosed in red weatherproof globes, readily distinguishing the boxes in cases of emergency on dark nights. The lamps are wired in groups supplied from the regular metered central-station service of the nearest fire-engine house. Attendants on duty at these posts switch the marker lamps on at dusk and off at dawn. To insure maintenance of the markers, police officers are instructed to report any lamp burned out or broken. Small renewal stocks are kept at each engine house, and a fireman is sent out to make the replacement as soon as reported. According to Mr. Douglass Burnett, of the Baltimore Consolidated Electric Light & Power Company, which supplies the energy for these fire-box markers, Mr. J. B. Yeakle, local superintendent of fire-alarm telegraph, plans to extend the signal-lamp system to other alarm boxes, the present installation having already proved its utility and value.

Wiring and Illumination

Indirect Lighting

At the December meeting of the London Illuminating Engineering Society a paper on modern methods of indirect lighting was read by Messrs. F. W. Willcox and H. C. Wheat. A large number of pictures of indirect-lighting installations were shown. The authors divided the methods of lighting into four classes, namely, direct lighting in which the greater part of the illumination is received directly from the source of light or through reflectors; direct lighting in which the greater part of the light is received from diffusing globes and spheres; semi-indirect lighting, and indirect lighting proper. The comparative advantages of these different methods were discussed. The authors brought forth arguments to combat some objections that have been raised to indirect lighting. For instance, it is thought by some that with this method the brightness of the ceiling is too high, but the authors quoted figures to show that the brightness is in general not more than about one-tenth candle-power per square inch. In the same way the objection that too much light is given to the walls was shown not to be serious, as a moderately high illumination is usually needed there in order that pictures and the like may be shown to advantage. The argument stating that it was a disadvantage to the indirect-lighting fixture to have the bowl appear dark was met with the statement that when several lamps are placed at intervals the light given out from one unit serves to illuminate the bowl of the next to some extent, and hence this dark appearance is not so prominent.

Indirect lighting is considered by some to produce a flat and cheerless effect, but this impression usually soon passes off. As an instance of the possible efficiency of the system, the authors quoted a case in which 4.83 lumens per watt were obtained. This is a result which appears distinctly high, and is probably attainable only under very favorable conditions. It is now recognized that indirect lighting is not "shadowless," but merely produces very soft shadows.

In the discussion several speakers expressed the opinion that the semi-indirect system of lighting gives preferable results from the artistic standpoint. Mr. C. A. Baker remarked that total indirect lighting makes the plans of the lighting engineer subservient to the nature of the walls and ceilings in the rooms, which naturally darken with age. He also pointed out that with an adjustable suspended lamp one can easily alter the illumination within wide limits and secure as much as 6 ft.-candles if it is desired. With indirect lighting one cannot make this alteration, and a liberal allowance of light is therefore necessary under this system.

An interesting addition to the discussion was presented by Mr. V. H. Mackinney, who showed the new Holophane semi-indirect lighting unit and several photographs made of rooms lighted with this unit taken entirely by artificial light. The unit consists of a specially designed inverted bowl, which directs approximately 75 per cent of the light upward, a large amount of the remaining 25 per cent being transmitted downward. Mr. Mackinney showed an interesting method of displaying the distribution of light from units instead of polar-candle-power curve. He reproduced a photograph of a room on which was mapped out below the photograph the illumination on the working plane. The distribution of surface brightness on the ceiling was shown above the photograph and the distribution of brightness on the walls was shown at the side. It was suggested that this method of showing the distribution of light from a unit would often be appreciated by the non-technical public, who are apt to be mystified by elaborate diagrams and polar curves but who readily understand the method used by Mr. Mackinney.

Bell and Lamp Signal Systems—I.

By Sydney F. Walker.

One of the greatest among the difficulties that have been encountered in the operation of electric signals in mines of all kinds has been the great drain upon the batteries and the difficulty of keeping them in working order. No battery more complicated than the open-type Le Clanché was considered acceptable for a long time. Later the mercury bi-chromate cell introduced by Fuller met with some

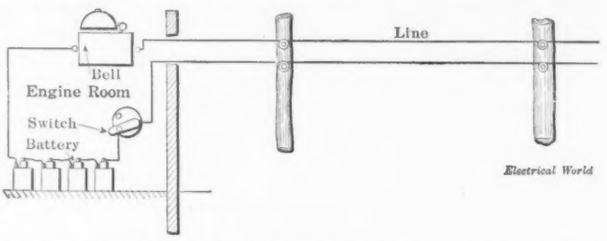


FIG. 1—DIAGRAM SHOWING ARRANGEMENT OF OLD FORM OF TWO-WIRE ENGINE ROAD SIGNAL IN BRITISH COLLIERIES

favor, but in the majority of cases that battery was thought too complicated. The Le Clanché battery, as is well known, will not withstand heavy drains of current unless special provision is made to enable it to do so. In the early days of electric signaling the pioneer who had the matter in hand did not appreciate that fact. The writer's experience has indicated that the secret of success with the Le Clanché battery for mining signals consists in making the individual cells very large and in having a large carbon plate surface, a large quantity of oxide of manganese and carbon inside the porous pot and the oxide of manganese of as high a percentage as possible. Like all chemicals that are sold in the open market, commercial oxide of manganese varies in quality, the variation on the commercial oxides of manganese being from 25 per cent up to 90 per cent. Bearing in mind that the 30 per cent variety will contain other elements, which will start polarization when the sal-ammoniac solution penetrates to them and the cell has commenced to work, it is not surprising that cells made up with this form of manganese run down very quickly. On the other hand, cells made with 90 per cent and over—the higher the better—will withstand a leakage current for a long time, and even a short-circuit for a certain time, without giving out.

In British collieries the open-type Le Clanché cell has for some years been giving way to the dry cell. The first

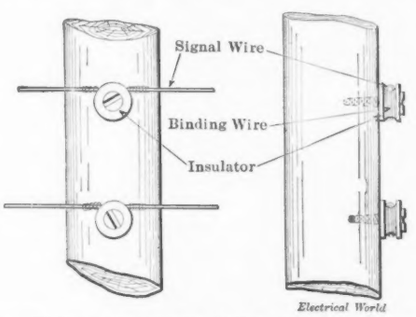


FIG. 2—WIRES AND INSULATORS FIXED TO PIT PROPS

dry cell was brought out nearly thirty years ago. As usual, though the idea was good, its design was bad and the cells were not satisfactory. Modern dry cells, in which care is taken to use oxide of manganese of great purity, carbon of great purity and to have a large supply of sal-ammoniac in solution, perform their work as satisfactorily as do the best of the open-type cells.

Of the early signals employed in British collieries mention should be made of the simple engine-room signal, con-

sisting of a single bell, connected to a battery of Le Clanché cells and to two naked iron wires. The connections were made as shown in Fig. 1. By pressing the two iron wires together the circuit was closed and the bell rang. The naked iron wires were stretched along the side of the road and were secured to small earthenware insulators, held to props, beams or plugs by the aid of screws. Troubles arose in the operation of this signal owing to the leakage from one naked wire to the other and to the accumulation of dirt, coaldust and other matter upon the wires. The dirt trouble was easily dealt with when once those who had to use the signal understood it. At first it was thought that the signal was out of order because it could sometimes be rung from a distance from the engine room but not near by. The miners were instructed to clean the wires in any convenient way before bringing them into contact with each other, and that trouble ceased.

The trouble due to the leakage current proved to be more serious. If, as very frequently happened, the air of the mine was humid, the moisture condensed upon the insulators and the props supporting them, and there was the usual multiplication of leakage paths. The leakage problem was solved in two ways: First, by making the cell very large and of the best material, as explained above, and, second, by employing a relay in extreme cases. The writer placed a number of cells in connection with the naked iron wires and the relay, so that the leakage current could be reduced to a minimum. The main battery was connected to the contacts of the relay and the bell. The result obtained was highly satisfactory.

One other trouble which arose in connection with these signals was occasioned by the falling in of the roof and the repairing that was done on the roads at night. The repairers seldom attempted to keep the wires clear of each other when taking them down to make necessary repairs behind the props supporting them. A fall of roof invariably brought the two wires together, thereby forming a short-circuit and exhausting the battery. The trouble was overcome by inserting a switch between the bell and the battery. In the writer's experience he found that a substantial form of plug switch answered best. The engine man could carry the plug in his pocket, so that there could be no chance of connection being made during his absence. When falls occurred in the night the battery did not suffer.

An extension of the signal shown in Fig. 1 was frequently employed in the early days, when the steam haulage engine was placed on the bank, the haulage rope passing down the shaft, around pulleys at the bottom of the shaft and thence along the engine road. It was necessary, of course, to signal to the engine room, and hence the battery and bell were located there, one insulated wire and one naked wire being placed in the shaft for the purpose. In some cases a second insulated wire was installed in the shaft, but in the writer's experience it was wiser not to do so. The use of this wire increased the cost of installing the signal, and it also increased the liability of breakdown. The insulated wire in the shaft was a very frequent source of trouble. Usually it was stapled to plugs in the side of the shaft, and the staples often cut through the insulation. Since the advent of compressed air, and especially since the electric motor has come into use for driving haulage plants in mines, the plant on the surface has gradually been done away with and the machinery placed underground.

Another natural development of the signal shown in Fig. 1 is that shown in Fig. 3, in which there are two bells, one at each end of the road, and either two or three naked galvanized wires. One battery was usually employed, though some electrical men and some colliery managers liked to have two. The usual arrangement of connections was that in which the one battery was placed in the engine room with one lead connected to the third return wire. The other terminal of the battery was connected to the bell, and a wire from the first bell led to the second bell at the other end of the engine road. A second wire from the other side of the second bell was brought back to the neighborhood of the engine room. It will be seen that by bringing the second wire into contact with the return wire by rubbing them together the circuit was completed and both bells rang together. The same troubles arose in the maintenance of this signal as with the one shown in Fig. 1, but they were very much accentuated. The leakage paths were increased, and the chances of wires coming together from falls of roof and during repairs were also increased. The employment of a second battery at the farther end of the road was evidently quite useless, as it would not be so easily reached for cleaning and repairs, and it was usually exposed to considerably more local leakage than the one in the engine room. The third wire was often dispensed with, the battery being connected to ground at the engine room, the bell at the far end being also connected to ground, as shown in Fig. 3. Pressing the two wires together as before completed the circuit. A trouble with this signal in addition to those mentioned above resided in the ground connection. Only a small current was required to operate the signal, and there was no difficulty in obtaining a good ground connection at the engine-room end, but it was sometimes difficult to maintain a good connection at the farther end. Where there was moist earth, driving a spike into it was usually sufficient, or a connection could be made to the delivery pipe from a pump, or even to the rails. In some cases, however, the ground at the farther end was very dry, and in those cases the ground contact could not be relied upon.

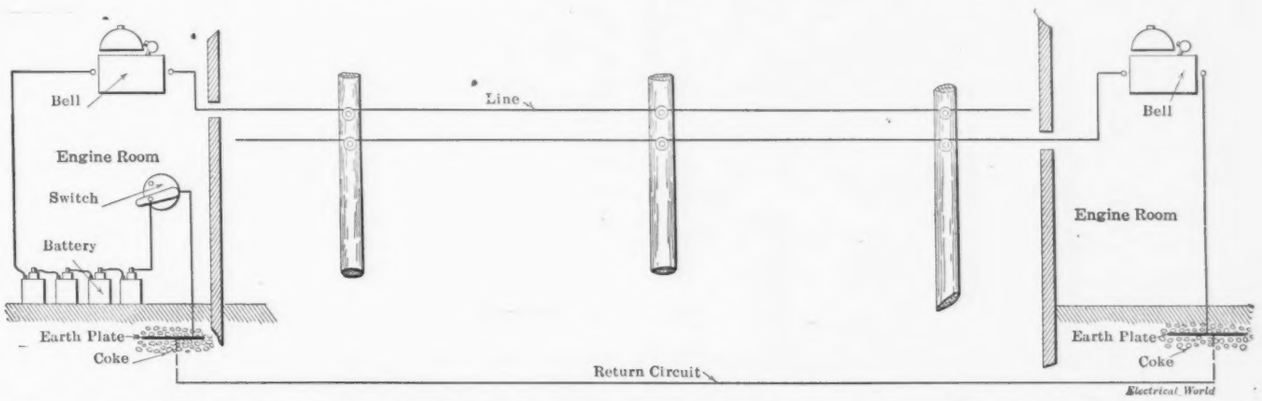


FIG. 3—CONNECTIONS OF OLD FORM OF ENGINE ROAD SIGNAL, WITH A BELL AT THE END OF THE ROAD AS WELL AS IN THE ENGINE ROOM

In a later instalment the signals used in several well-known collieries will be discussed, and the growth and development of modern shaft signals will be traced.

Recent Telephone Patents

Switchboard Circuits

Mr. R. H. Manson, of Elyria, Ohio, has patented a trunk circuit adapted for use with switchboards of the two-wire type. The trunk is of the calling-circuit variety and provides the full ringing, disconnect and guard signal features. One of the special features is the control of the application of ringing current by the "B" operator from the "A" end. Thus, no matter how the "B" operator manipulates the ringing keys, no ringing current is sent out until after the "A" operator has picked up that particular trunk. This patent is assigned to the Dean Electric Company.

A patent granted to Mr. H. G. Webster, of Chicago, and assigned to the Kellogg Switchboard & Supply Company describes an automatic ringing circuit. With this type of circuit ringing is started by depressing a locking key and is then intermittently maintained until released by the response of the called subscriber. In the particular circuit described the release of the ringing current is controlled by a differential relay. A balance in the windings of this relay is brought about by the response of the called subscriber.

Miscellaneous Appliances

Mr. J. K. Rhodes, of Brooklyn, N. Y., is the inventor of a transmitter for the use in aiding persons talking to the deaf. The particular feature lies in including within the transmitter casing an adjustable resistance which controls the sensitiveness of the instrument. The resistance coils are disposed about the periphery of the casing, while the contact dial and arm are upon the rear of the casing so as to be concealed when the transmitter is in use.

Messrs. E. E. Dildine and J. A. Rugh, of St. Paul, have patented a cordless jack box in which the connections are made without the use of cords by the registering of the plug parts with the various jack springs. The plugs consist of collars of various lengths insulated from each other, and these collars make contact with the jack springs in such a way as to complete the desired circuits, each collar serving as a part of the circuit. This patent is assigned to the Sandwich Electric Company.

Letter to the Editors

Employer's Right to Employee's Invention

To the Editors of the Electrical World:

Sirs:—Referring to the discussion of the employer's right to an employee's invention appearing on page 57 of your issue of Jan. 4, while I agree that an employee is legally bound to comply with the provisions of a signed agreement, I beg to take issue with the statement that he is morally bound as well.

The question arises, How is an employee induced to enter into a contract with his employer? If he enter a contract which binds both parties to certain duties, the moral obligation to assign inventions is obvious. This applies mainly to employees of high standing whose ingenuity is their valuable asset, on which their compensation is based.

It is quite different, however, with the employee who, whether having an academic or a less thorough training, is obliged to look for a position in the "Wanted" column among advertisements for butchers, barbers, colored porters, "German and wife for farm," etc. Such a man's compensation, as a rule, is not based on his experience and personal value as a worker, but rather on a common market price, and eventually on the pressure of work. Employees of this type are often requested to sign agreements which bind them to assign any invention to the employer, although the latter, in turn, has no obligation to the employee but may free him any time at pleasure. The reason for assigning so valuable an asset without receiving anything in return is the fear, or even the surety, on the part of the employee that he otherwise will lose his job. The morality of such an action is of a kind equivalent to the practice of an unskilled laborer who pays cash to the boss to keep his job.

Many employees sign away their inventive activity in the expectation that they will never have to turn over anything of value, but the mistake of this course will be apparent as soon as they happen to strike a valuable idea. It is the employee of this class, too, who receives little encouragement from employers toward inventive activity, and whose success is entirely dependent on himself. Therefore the product of his private labor should not without due compensation be assigned to those who have not contributed to its success. If the employee receive compensation for regular labor only, his obligation to his employer should stop right there, and any disposition of his own time and labor should be compensated for additionally; otherwise his condition would approach that of industrial slavery.

The United States patent law expressly gives the inventor the sole right to make, use and vend his invention for the term of seventeen years, without restricting this right in any way. The patent having an equivalent value can be handled the same way as any tangible property. Why should one be forced, then, to give such property away without compensation? Is it morally right to receive another's property without any compensation whatever, although, on the other hand, demanding both compensation and profit for one's own product? And is it morally right to take from an economically weaker person the only chance of rising to a deserved higher position? Morality, it is true, is a relative conception, but still there can be only one morality for which an individual or a people should strive.

Contracts binding an employee beyond the term of his employment, with penalties far exceeding the earning capacity of his whole life and vitally impairing his ability to earn, have been in vogue in Germany, particularly in the chemical industry. Through the efforts of the Verein der Technischen Privat-Beamten, mainly on political grounds in influencing legislation, the "morality" of such contracts has decreased until they now have no standing in the courts whatever, being considered contrary to good morals.

The claim of employers to patent rights of their employees varies with different instances. Many firms will claim shop rights only for furnishing material and paying for labor spent, while others request submission of all inventions, eventually paying a nominal sum for patents assigned and releasing all unsuitable inventions. Still others will pay all expenses for patent applications, retaining for assignment only the suitable patents. A large manufacturing concern has the form for assignment of all future inventions printed on its employees' record cards, and the affirmation by signature of the employee's veracity regarding his record at the same time assigns, without any compensation, any inventions he may make.

It seems pitiful enough that a striving and unsuspecting inventor is so frequently subjected to the freezing-out process; but even worse is the fact that all chance should be taken from him before he even has the opportunity of being an inventor.

That the employer legally has the right to an employee's inventions has never been fully settled by the courts; and this question may remain in doubt until the general custom has prevailed long enough to canonize it. In that event, at some future period it may be "morally right" to claim an employee's patent rights.

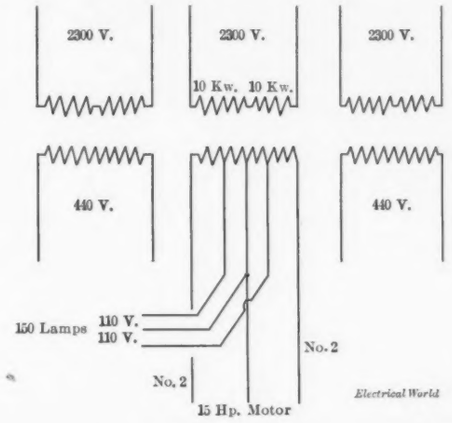
Youngstown, Ohio. A. F. Jobke.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Rearrangement of Three-Wire System to Reduce Voltage Fluctuations

In a Kansas flouring mill operated by 220-volt, three-phase motors trouble was experienced with the flickering of the lamp circuits supplied from the same feeders as the motors. As first installed, the transformers were arranged to furnish 220-volt, three-wire service from a single phase



DIAGRAMMATIC VIEW OF CIRCUIT ARRANGEMENT

of the three available. The 10-kw transformers were provided with middle taps and these were first used as the neutral connections of the 110/220-volt, three-wire system for the lighting service.

With the 15-hp motor fed from the same lines, the lamps flickered badly each time the motor was started and stopped or underwent a change in load. Connections were then changed to the arrangement shown in the accompanying sketch, the three-wire system being converted to 110/220-volt service, with the "outside wires" taken from new quarter points midway between the original neutral and the outside motor circuits. In place of the 220-volt lamps formerly used, 110-volt lamps were installed. The result has been the practical elimination of the flicker that was formerly so objectionable, probably owing largely to the fact that the low-voltage filaments have greater heat-storage capacity and thus are less sensitive to voltage variations than the 220-volt lamps.

Drying Out Submerged Machines

Owing to the fact that generating stations are often located on river banks, because of the ready supply of water for boiler feed and condensing purposes, and inasmuch as flood conditions often prevail on such streams, it not infrequently happens that the generating apparatus is submerged. Of course, on streams subject to periodic floods precautions are taken to keep the equipment above the highest point ever reached by the water. In times of flood very little can be done while the apparatus in the station is under water. Service is interrupted, and often after the water has receded it takes a number of days to dry out the apparatus before service can be restored. It is on such occasions that the operating engineer must exercise his ingenuity, since it is out of the question to build special means for drying out the machines, and since it is expedient to start the machinery at the earliest possible moment that this can be done.

In a late flood which engulfed the equipment of a central station, hand pumps were mounted over the various pits containing the engine and turbine auxiliaries until a centrifugal pump could be hitched up and arranged to throw water out of the engine-room window. It happened that the turbines were set high enough to escape the water, but all of the auxiliary machines and the equipment in the boiler room were submerged. When the water in the river began to recede, the submerged auxiliary motors were raised as quickly as possible and the field coils and armatures removed. After cleaning and rough drying the machine windings affected, the coils and armatures were placed in drying ovens. The armatures of the larger machines, which were too heavy to be readily handled, were dried by means of steam radiators mounted in the space occupied by the field coils. The ends of the machines were covered with a tarpaulin, and small fans were used to keep the air in circulation around the armature. Other units were dried by means of stoves placed inside a temporary wooden framework built over the sets and covered with strong paper, fans being arranged to maintain a continuous air flow through the inclosure. By this means it was possible to start some of the units in a few days, and the final drying-out process was effected by the application of a heavy low-pressure current.

In a flood which was experienced at Kansas City, Mo., some ten years ago the station of the Kansas City Electric Light Company was submerged, the water reaching just above the main bearings of the alternators. Not only was every piece of electrical machinery in the station soaked with water, but upon everything there was also a thick deposit of mud. The high-tension busbars, which were below the main floor, were also filled with this same slimy mud, which was not thick enough to shovel and yet too thick to pump. In addition, every piece of electrical apparatus was covered with a liberal supply of cinders, refuse and other debris. As soon as the water became low enough the mud was scraped and washed off the apparatus and a hose was turned on the armatures. After washing out all coils and picking the cinders out of the small cracks, heaters were used to dry out the machines, and when some of the moisture had been thus driven off, energy from another station in the city, which luckily was in service, was secured for completing the drying-out operations. It was nine days before the first alternator was completely dried out. This machine was operated on an overload, but after a day or so some coils burned out. The same trouble was experienced with the second alternator, and in each case the coils lost were those located at high-water mark. It was supposed that they were damaged by chemicals which floated down from the works farther up the river. The smaller armatures were dried out by means of steam coils, fires and compressed air, and the cores and coils of the transformers were taken out of their cases and washed and dried in the sun. Eleven days after the flood the station was again in operation. Recent experience with submerged motor-driven pumps in mines also bears testimony to the wonderful amount of abuse modern electrical apparatus can withstand and still be put back into service.

Overhauling an Electric Station Engine

By J. F. Hobart.

The management of a small station having occasion to install another steam engine, and having little cash to spare, cast about for a good second-hand engine and was offered an 11-in. by 13-in. automatic, self-contained engine, with the guarantee that it would be completely rebuilt and placed in such condition as to do the same work as when new. The engine was purchased and installed, whereupon it developed that the governor was faulty, there being considerable lost motion in the bolts and pins upon which the regulating parts were pivoted. After considerable correspondence it was agreed that new bolts should be procured at the expense of the dealer who sold the engine, and thus the regulator matter was finally satisfactorily settled. Later trouble developed in the crosshead, and it was found impossible to keep that connection tight. The pin would work loose, and no matter how well or frequently the crosshead brasses were keyed up, a bad knock between them and the pin would always manifest itself.

Investigation exposed the repair methods shown in the diagram. The pin, shown in section at *A*, had been turned down nearly 3/16 in. smaller in diameter than when first made, probably owing to the fact that the crosshead brasses had worn badly and would not fit the pin. After turning down the pin—which never should have been done—the brasses were babbitted to bring them down to the size of the pin. The layer of babbitt shown at *BB* was only 3/32 in.

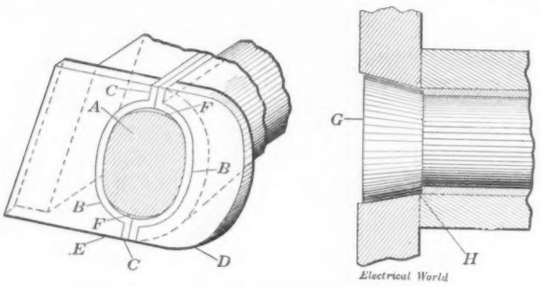


DIAGRAM SHOWING FAULTY REPAIR METHODS

in thickness, and the 2 tons or more of steam pressure on the piston, acting against the babbitt *BB*, forced the soft metal out of place so that a thin additional shim was required every morning to keep the wrist connection tight.

To make matters worse, the shop which did the babbitting chanced to be out of "special" babbitt at the time the repair job was done and lined the brasses with ordinary babbitt, fit only for large journal bearings. It was also found that the engine attendant in filing off the soft babbitt which daily oozed out of the bearing had relieved the edges of the babbitt at *FF* so very much that nearly one-half the bearing surface of the babbitt against pin *A* had been removed. The taking away of one-half the bearing surface necessarily increased the pressure of the pin against the babbitt, thus forcing the soft metal out of the brasses onto adjoining surfaces. It was also discovered that the pin had run loose at some previous time until the taper head had been drawn into the crosshead beyond the tapered portion *G*. This permitted an interference at *H*, and the pin being unable to enter the crosshead farther remained loose therein, constantly wearing the hole larger and becoming looser all the time. To remedy this trouble, the engine dealer was called upon to furnish a pair of new brasses from the engine builder, and a new pin was made in a local shop, with the tapered portion or head *G* larger than the old one so as to fit the enlarged taper hole in the crosshead. A mechanic carefully fitted the new pin into the distorted hole in the crosshead, filing, chipping and scraping the metal away until a full fit was obtained along the original angles but slightly larger in diameter.

A thin coat of red lead was evenly distributed with the finger over the entire taper surface of the hole in the crosshead in fitting the pin, the spots coming in contact being indicated where the red lead was rubbed off. In this manner the engine was restored to its original condition and was actually as good as new as far as the crosshead and its pin and brasses were concerned. It should be pointed out in this connection that one should never buy second-hand engines without taking them down and giving them a thorough survey.

Overcoming Overload on Series Arc-Lamp Circuits

By Charles E. High

It sometimes happens in planning the installation of a series arc-lighting system that sufficient allowance has not been made for the future growth of the plant, with the ultimate result that the constant-current transformer which has been provided becomes overloaded. Many times this overload is not sufficiently large to justify the expense of securing another constant-current unit. This was the case with our plant. A twenty-five-lamp transformer had been installed with the plant and first connected for 60 per cent load. This was later changed to 80 per cent load, then to full load, and with the addition of still more lamps the intensity of the light began to diminish. To overcome this difficulty a scheme was devised which is shown diagrammatically in the accompanying illustration. The primaries of two 3-kw, 2200/440-volt stationary-element potential transformers were connected in multiple with the

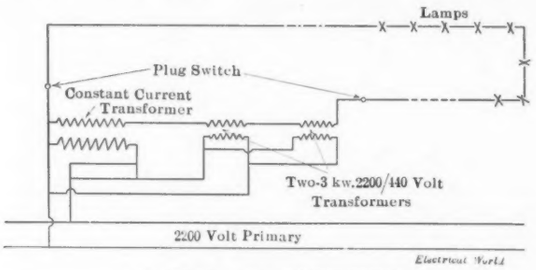


DIAGRAM OF CONNECTIONS

primary of the constant current unit, and the secondaries of all three transformers were then placed in series and connected directly to the lamp circuit. This plan allowed the operation of thirty-seven lamps on a twenty-five-lamp circuit and gave satisfaction in every way. The lamps returned to their normal brilliancy and no transformer was heated excessively. The constant-current transformer, operating on the margin, as it were, and maintaining the current at 6.6 amp, was assisted by the stationary element units, which boosted the voltage on the circuit and helped supply energy to the extra lamps. Care must be exercised in making the connections that proper polarities be maintained in the transformers.

Methods of Locating Trouble

What methods are used for determining the location of grounds and short circuits on underground high-tension three-phase feeders? P. G. A.

In one system with which we are acquainted, the grounds on three-phase feeders are first located by means of low-tension direct current through a voltmeter. Then the bank of lamps passing from 10 amp to 15 amp is connected to the grounded phase through a current-reversing apparatus which reverses the direction of the current once every five seconds. A man equipped with a compass passes over the cable and the fault is indicated by a decreased deflection. In ordinary practice the presence of smoke in a manhole indicates within a very short distance where a short-circuit occurs.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Change of Energy Loss with Speed in Direct-Current Machines.—W. M. THORNTON.—With the increasing use of large turbo-generators the exact knowledge of the change of energy loss with speed becomes important. No single rule covering the whole range of speeds is known at present, but different rules are assumed for low-speed ranges and for high-speed ranges. The present paper gives an account of measurements made for the purpose of examining the dependence of loss on speed, using a 7½-hp direct-current four-pole motor running at a normal speed of 1500 r.p.m. The windage tests are novel in that they were made by running the machine in air and in vacuo. One of the conclusions from the present experiments is that there are at least two terms in the wind resistance of electrical machines, one corresponding to the formation of eddies, the other to a skin friction. For modern types of covered armatures only the former wind resistance factor becomes important at high speeds, while for smooth, covered surfaces the latter is not negligible at low speeds. The bearing friction loss is relatively higher at low speeds than at high, the index decreasing with rise of speed. Pole lamination has apparently an effect upon hysteresis as well as upon eddy-current loss. In the discussion H. H. Law spoke of several cases where simple alterations in the ventilating arrangements had effected an enormous reduction in the windage losses. In new designs the determination of the windage loss was largely a matter of experiment, but the influence of surface speed had to be carefully watched. C. H. Davidson remarked that in turbine-driven plants the accurate determination of windage losses was of the highest importance because they formed such a large proportion of the total. In large direct-current sets running at high speeds and fitted with powerful forced ventilation the windage loss might amount to as much as 40 per cent of the total losses and in alternators to 25 per cent or 30 per cent of the total.—London *Electrician*, Dec. 20, 1912.

Polyphase Induction Machines.—G. VALLAURI.—An article illustrated by diagrams on the passage of the polyphase induction machine through synchronism. In a polyphase induction motor the torque developed consists of two torques which are of an entirely different nature. One is the torque due to the action of the rotary field on the rotor currents induced by it (currents in the rotor windings and eddy currents in the rotor iron). The other is the torque due to the action of the rotary field on the magnetization produced by it in the rotor iron. For a fully loaded motor the latter torque is only 0.5 per cent of the total torque and is usually neglected for this reason. However, for the exact measurement and separation of the losses, as well as for the explanation of the power variation which occurs while the machine passes through synchronism, this small torque is of great importance and the fact that it has been neglected has caused misunderstandings. The author endeavors to sketch the functions of this torque.—*Elek. und Masch.* (Vienna), Dec. 22, 1912.

Synchronous and Non-Synchronous Reactance.—J. REZELMAN.—Another article in his long serial in which the author investigates the reactance of alternating-current machines. In this chapter he discusses fully the case of alternators having solid salient poles, both single and polyphase. A 75-kva, eight-pole, three-phase alternator producing 120-volt, 50-cycle energy at 750 r.p.m. is the basis of the discussion and calculations.—London *Electrician*, Dec. 27, 1912.

High-Speed Machines.—MAURICE LE BLANC.—The first part of an article discussing the possibilities of constructing machines for very high angular speed. The author explains how most of the difficulties disappear if the rotor does not revolve around a rigidly fixed axis but is able to choose in each instance its axis of rotation just as a spinning top would do on a perfectly polished surface. The article is to be continued.—*La Lumière Elec.*, Dec. 21, 1912.

Magnetic Leakage in Transformers.—J. MURRAY WEED.—In a former article by the author formulas were derived for calculating the reactance of transformers and the eddy-current losses in the conductors, both of which are directly due to the leakage flux. The present instalment has reference to the nature and calculation of the mechanical stresses which are produced by this flux and which, at times of short-circuit, may result in serious damage to or even destruction of the unit.—*Gen. Elec. Review*, January, 1913.

Mercury-Vapor Rectifiers.—B. B. SCHAEFER.—An English translation of his recent German paper on improvements in mercury-vapor rectifiers of large ratings, having steel tubes as containers. The original German paper has already been abstracted in the *Digest*.—London *Elec. Review*, Dec. 27, 1912.

Lamps and Lighting

Controlling Equipment for Train Lighting.—A note on a recent British patent (No. 4119, Dec. 19, 1912) of G. Inrig and L. Inrig. For controlling the output of a self-regulating reversible dynamo used in conjunction with accumulators for train lighting, the armature is built in two sections called the armature disks and the core. A non-magnetic metal casing or "tube socket" is keyed to the shaft against the commutator. One end of a soft-iron tube is secured to this socket, the other extending through the armature tunnel. The armature disks are secured on this tube. The core consists of soft-iron disks threaded on a metal tube fitting freely on the shaft. The core is cone-shaped. An ordinary Pickering ball governor is fitted on the shaft at the pulley end, one end of the links being attached to the core and the other to a movable collar on the shaft. This controls a quick-break knife switch. A small electromagnet in series with the shunt fields is fitted to the machine frame, iron keepers being fitted on two of the brush arms. These magnets hold the brush rocker in position when the machine is working. When normal speed has been reached the governor closes the knife switch, which is in the accumulator circuit. As the speed varies the governor adjusts the position of the coned core in the armature so that the pressure is kept constant. It is also arranged that at excessive speed the switch is automatically opened.—London *Elec. Eng'ing*, Dec. 26, 1912.

Generation, Transmission and Distribution

High-Tension Constant-Current Operation of Mines.—SYDNEY F. WALKER.—An article in which the author points out the advantages of the Thury high-tension direct-current system over the three-phase system for mines. Two cables are used instead of three. This in itself is a great advantage in mining work. Furthermore, while with the three-phase system practically the full pressure of the service is present everywhere, with the high-tension constant continu-

ous-current system the full pressure between the two cables is present only near the switchboard. As the switchboard is receded from the difference of pressure between the two cables decreases. In mining work this appears to be a matter of considerable importance, since at the face of the coal, after allowing for all special arrangements for supplying the different districts, the pressure between the two service conductors would be comparatively small. With three-phase parallel working if a "short" occurs anywhere between two phases the whole service is put out of operation until the "short" is taken off and the cable repaired. With the high-tension constant continuous-current system the only effect of a "short" between two cables anywhere is the cutting out of the apparatus previously in service beyond the "short." The chances of shock with the high-tension constant continuous-current system would be considerably lessened in the working of most mines by the fact that the pressure between the live cable and the return conductor, the outer, decreases all the way from the surface to the workings. Finally the direct-current system is believed to be more economical.—London *Elec. Review,* Dec. 27, 1912.

French Water Powers.—Henri Presson.—A list, with maps, of water-powers along the coasts and the frontiers of France. This completes the author's extended statistical articles on water-powers in France.—*La Revue Elec.,* Dec. 6, 1912.

Traction

Electrification of Trunk Railways.—G. Huldschiner.—A comparison of the different systems. High-tension direct current for trunk railways requires the highest first cost of all possible systems. "Articles in American journals attempting to prove that the contrary is true show only too clearly that their conclusion is inspired by the hopes of industrious designers of direct-current machines." It is often also said that the three-phase system is suitable perhaps for railways with heavy grades, while for the flat country the single-phase system is the proper one. In one important respect this is wrong, since the single-phase motor with its speed characteristics adapts itself very well to mountainous roads, while the three-phase motor adapts itself directly to the requirements in a flat country where the highest power is required at the highest speed. Other considerations, however, change completely this conclusion as to the adaptability of both types of motors for flat and mountainous roads. The example shows that when there are some reasons in favor of one system there are always other reasons against it. The author then discusses the problem of regenerating energy. The economical importance of regeneration is usually considerably overrated, according to the author, the real importance being in the simplification of the work of the locomotive attendants. However, braking with regeneration of energy is not without danger, in case the electric connection between the motors and the station should be interrupted in some way and the emergency brake should not act immediately. As to line construction the difficulties of the three-phase system are thought to be overrated. The author thinks that it is too early to draw general conclusions. There is sense in agreeing on a uniform system for a state like northern Germany, but there is no reason, he thinks, in trying to reach international agreements as to one standard system. For the present it is best to build as many railroads of as many different systems as possible.—*Elek. und Masch.* (Vienna), Dec. 22, 1912.

Boosters.—J. G. Cunliffe and R. G. Cunliffe.—An article on railway feeder networks. Recent developments in street traction have resulted in a greater intensity of electrical loading, i.e., in power demanded per mile of track. Boosting is thus becoming increasingly necessary. The main principles underlying the use of boosters, both positive and negative, are considered.—London *Electrician,* Dec. 27, 1912.

Marine Propulsion.—W. P. Durtnall.—A paper read before the (British) Society of Engineers. The problem of marine propulsion is stated and a historical survey is made of the different solutions. The thermal and propeller efficiencies of steam-driven ships are discussed, and the conditions that the motive power must comply with are tabulated. The steam turbine is considered and is shown to be unsuitable for direct coupling to the propeller shaft. Finally an electric transmission system, known as the "Paragon," is advocated and described. The equipment of the United States ship *Jupiter* is mentioned.—London *Electrician,* Dec. 27, 1912.

Installations, Systems and Appliances

Insulation, Recorder and Leakage Current Indicator for Alternating-Current Circuits.—At the recent exhibition of the Physical Society in London the insulation recorder shown in Fig. 1 was exhibited. The leakage current from the three-phase system to earth, after passing through a choking coil, is measured on a recording instrument and a leakage indicator connected in series. The pointer of this latter instrument is fitted with a contact so that when the current exceeds a predetermined amount a battery circuit is closed, the fuse *F* blown and an alarm bell begins to ring. To insure the absolute working of the instrument a small coil in the secondary circuit holds the pointer over against

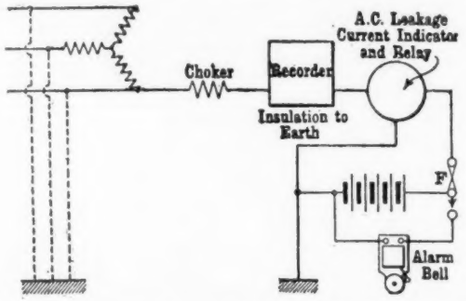


FIG. 1—DIAGRAM OF INSULATION RECORDER AND LEAKAGE-CURRENT INDICATOR

the contact once contact is made. The recorder is operated on the tapping principle, the pen touching the paper only at short intervals. This makes the operation very sensitive and accurate. The testing system is traversed only by low-tension direct current and is therefore perfectly safe to handle.—London *Electrician,* Dec. 27, 1912.

Tariff.—Voigt.—Some remarks with respect to the use of the Potsdam tariff which has been mentioned repeatedly in the *Digest.* A tariff based on the same principles is used for agricultural districts, there being a fundamental charge per year per acre and an additional charge per kilowatt-hour consumed. Discount is allowed on the latter charge according to the amount of energy used.—*Elek. Zeit.,* Dec. 19, 1912.

Wires, Wiring and Conduits

Aluminum Arresters.—R. T. Wagner.—The first part of an illustrated article on the construction, installation and maintenance of aluminum arresters and their auxiliaries. The first aluminum arrester designed for use on a large transmission system in this country was put in service about seven years ago. Since that time hundreds of installations have been made under varied conditions in all parts of the world. While essentially unchanged, the later designs naturally embody certain improvements resulting from both laboratory work and a careful study of all installations. The present instalment discusses the formation of the hydroxide film on the aluminum, the dissolution of the film, the construction of the arrester, horn-gaps, charging resistances, the difference between arresters for grounded and non-grounded neutral circuits and the transfer device. —*Gen. Elec. Review,* January, 1913.

Electrophysics and Magnetism

Entropy and Temperature.—V. KARAPETOFF.—A discussion of the relation between entropy and temperature with illustrations by means of analogues. In dealing with the common forms of energy we consider two factors, an intensity factor and a quantity factor. For instance, in electrical energy the ampere-hour, or quantity of electricity, is the quantity factor, and the voltage is the intensity factor. The nature of each of these factors is easy of conception. Heat energy is similarly characterized by temperature, the intensity factor, and entropy, the quantity factor. An understanding of the nature of entropy, however, is usually acquired with considerable difficulty, and in order to give a tangible picture of this quantity factor the author first reviews three old analogues in explanation of entropy, one by Zeuner and two by Mach, and then proposes and discusses a fourth, in which a fictitious heat-fluid or caloric is introduced. The entropy of a body is defined as the quantity of caloric in it, and the temperature as the pressure of this caloric. Some caloric is assumed to be in a bound state within the molecules of the body and to be liberated during irreversible processes. A review is made of the principal thermodynamic phenomena in the light of this analogue or picture, and it is shown that changes in entropy, temperature, volume and pressure can be predicted by a simple reasoning.—*Gen. Elec. Review,* January, 1913.

Electrochemistry and Batteries

Storage Battery.—In connection with the exhibit of the Edison storage battery at the London Physical Society's recent exhibition some notes are given on the latest construction of the Edison battery. Several often-accentuated special features are no longer considered essential, for instance, the addition of cobalt and of bismuth to the active material. The electrolyte contains 0.5 per cent of lithium hydrate in a 21 per cent solution of caustic potash. The tubes for the material, which are vertically arranged in the frame of a positive electrode, have a length of 4½ in. and consist of nickel-plated steel finely perforated. They are strengthened by small rings, are provided with a spiral overlapping seam and contain nickel and nickel hydrate. The negative material is contained in the well-known small trays (or pockets) of very fine nickel-plated steel, likewise very finely perforated. They are provided with lids bent over at the edges and contain iron oxide with some mercury compound. These small trays are horizontally arranged. In the larger cells two square frames are united to one electrode of double the height. A five-plate cell weighs 4.6 lb., a twenty-five-plate cell 41 lb.—London *Engineering,* Dec. 20, 1912.

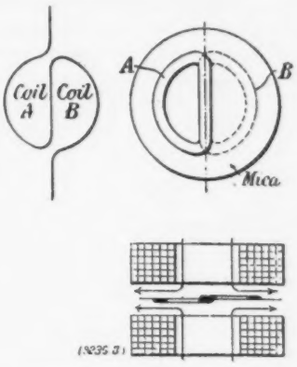
Copper and Nickel in Electric Furnace.—M. STEPHAN.—An account of some experiments on the reduction of copper and nickel ores in the electric furnace.—*Met. and Chem. Eng'ing,* January, 1913.

Electrolytic Processes for Zinc.—VICTOR ENGELHARDT.—A paper on recent progress in electrolytic processes for zinc. The author gives a sketch of the different processes proposed, with special reference to the processes developed by the Siemens & Halske company and to recent advances made by that company in the making of lead peroxide and manganese peroxide anodes.—*Met. and Chem. Eng'ing,* January, 1913.

Electrolysis of Sodium Chloride.—A. J. ALLMAND.—An illustrated paper on two electrolytic cells devised by Billiter. The first is the Billiter-Siemens diaphragm cell with a horizontal diaphragm, being used in various plants. The second is the Billiter-Leykam gravitation cell, which is described in some detail.—*Met. and Chem. Eng'ing,* January, 1913.

Units, Measurements and Instruments

Alternating-Current Instruments.—Among the exhibits of a British firm at the recent exhibition of the Physical Society in London was the J. T. Irwin astatic alternating-current dynamometer, which is said to be practically uninfluenced by external fields even if irregularly distributed. The two moving coils *A B* (Figs. 2, 3 and 4) are of D shape, with their straight limbs adjacent and close to the axis of rotation. The current flows through them at any moment in the same direction. They are mounted side by



FIGS. 2, 3 AND 4—MOVING COILS OF ASTATIC DYNAMOMETER

side on a disk of mica, which is pivoted or suspended in the radial field from two fixed parallel coils joined in opposition. In one position the plane of the moving coil is parallel to the plane of the fixed coils. The natural period of the moving system is high, and effective air-damping is provided by the mica vane, which turns in a closed chamber. The close juxtaposition of the coils eliminates errors due to external fields. High sensitivity and quick working are claimed both for the suspended and the pivoted forms, and portable instruments measuring the volts, amperes and watts are constructed on this plan. In the Irwin reflecting dynamometer the moving coil has a robust suspension and a periodic time of one second. The resistance of the fixed coil is 0.03 ohm, its inductance 9×10^{-6} henry; the moving coils have a resistance of 20 ohms and an inductance of 3×10^{-4} henry. When they are fitted with a scale of 1 m radius a full-scale deflection is obtained with 0.01 amp in the moving coils and 6 amp in the fixed coils.—London *Engineering,* Dec. 27, 1912.

Voltage Rises with Electromagnets.—P. KUSCHWITZ.—The author shows that in the design of protective devices to prevent detrimental rises of voltage due to the disconnection of inductive apparatus it is not sufficient so to dimension them that there are no sparks at the contacts when opened. Care must also be taken that rises of voltage at other places of the circuit cannot hurt the magnet coils or the protective devices themselves. In order to find out whether this has been accomplished sufficiently a vacuum lightning arrester in parallel to the parts of apparatus to be protected has very appreciable advantages when it is employed as a testing instrument.—*Elek. Zeit.,* Dec. 26, 1912.

Air Condensers.—H. SCHERING AND R. SCHMIDT.—An illustrated description of a set of standard air condensers with units of 0.05, 0.02 and 2×0.01 mf, and also an account of an adjustable rotary condenser by means of which intermediate values can be obtained. Parallel connection is accomplished by putting the condensers one above the other so that the total capacity equals the sum of the single condensers. There is then no necessity of taking the connecting wires into consideration at all.—*Elek. Zeit.,* Dec. 26, 1912.

Pyrometry in Steel Works.—C. R. DOWLING.—A general account is given of the various methods at present available for the measurement of high temperatures. These include thermocouples, thermal radiation pyrometers, electrical resistor methods, optical pyrometers and calorimetric pyrometers.—London *Electrician,* Dec. 13, 1912.

Telegraphy, Telephony and Signals

Magnifying Feeble Telegraph Currents.—S. G. Brown.—An experimental lecture delivered at the recent exhibition of scientific apparatus by the Physical Society in London. Methods for increasing the relative power of cables are becoming very important. The first method described relates to improvements in the sensitiveness of the siphon recorder. In the siphon recorder of the moving-coil type inertia of the parts, back emf of the coil, friction of air, suspension and inking had to be overcome; the coil and siphon had to have a definite period of oscillation, depending upon the speed of the signals and ranging from 0.3 to 0.1 second. The sensitiveness could be improved by shortening the siphon (which is about 2.5 in. long as a rule) and by narrowing the coil (having 500 turns of 2-mil wire at a mean radius of ⅜ in.). The inertia of the coil and of the siphon should be equal in order to minimize the inertia of the system, but it was practically inadvisable to go below fifty or a hundred turns, and Mr. Brown hence magnified the motion of the coil in the first device he exhibited. A fine fiber, kept in tension by flat springs, was attached to an arm carried by the moving coil and to a vertical fiber on the siphon suspension device, which was fixed on an aluminum carrier held by a vertical fiber at the top and by two parallel fibers 0.2 in. apart below. The one leg of the siphon was on the axis of the suspension between the two latter fibers, and the whole suspension device was vibrated up and down by the aid of a lower (very weak) and an upper flat spring, so as to jerk the ink out. The siphon contained red aniline dissolved in methylated spirits, and its working end was ground flat to give closely spaced dots. When the instrument was adjusted to 10.5 natural periods per second, with a 300-ohm 300-turn coil, a current of 50 micro-amp gave a full-sized signal corresponding to a deflection of 0.1 in. on the paper, and the back emf was reduced to a quarter or less of its ordinary value. On the largest Atlantic cables an increase in speed of 30 per cent had been realized by these means. The second improvement concerned a thermoelectric relay. In this device a very light thermopile of five junctions (platinum, and platinum with 20 per cent of iridium) was kept oscillating between two small alcohol flames by an arrangement resembling the one adopted for the siphon, some of the fibers being phosphor-bronze wires. The flames were wick burners, each provided with a copper cap fixed above a few turns of a copper wire coil, which became hot and insured a steady production of vapor. In the neutral position both ends of the thermopile were dull red; when deflected by the cable current one junction became bright red, the other almost dark. There was a lag in the thermal current, but it was inappreciable for cable work, and in fact advantageous with simplex working, because it facilitated the balancing of the sending current which might affect the receiver. With a natural period of the coil equal to 8.7 periods per second and a 480-ohm 480-turn coil, a coil current of 0.03 milliamp gave a current of 0.81 milliamp from the pile through an external resistance of 42 ohms, the thermopile itself being deflected by 0.075 in. Thus there was a magnifying power of twenty-seven. The remarkable property of this relay was that its magnifying power was constant and that it multiplied the impulses received in exact proportion to their strength, as was shown by curves. How this was possible Mr. Brown further explained by the simple mechanical experiment that a heavy weight, suspended by a string coiled round a rotating spindle, could easily be raised almost without pulling the free end of the string up at all, because additional power came from the motor driving the spindle (a treadle in the demonstration). This principle of mechanical power magnification was utilized in a third device, by means of which it was possible to work an ordinary siphon writer, normally requiring 3 milliamp, by a current of 10 microamp. On a German-American cable an increase of speed of 40 per cent had been maintained in three weeks' trials by the aid of the thermocouple.—London *Engineering*, Dec. 20, 1912.

Wireless Telegraphy Generator.—E. F. W. Alexanderson.—An illustrated article in which the author first gives a few notes on the generating equipments used in present-day wireless-telegraph stations in which the spark method with 500-cycle energy is employed. He then enumerates the reasons why this system will probably be superseded in the near future by those using continuous trains of waves generated by high-frequency alternators. The paper describes the design of an inductor alternator for directly producing outputs at 100,000 and 200,000 cycles, and also an alternator in which telephone current is used for field excitation and in which the current generated by the armature has a volume larger than the energy used in the telephone for excitation.—*Gen. Elec. Review*, January, 1913.

Great Britain.—The annual report of the British Postmaster-General on telegraphy, telephony and wireless telegraphy. The most important event of the year was the transfer of the system of the National Telephone Company to the State.—London *Electrician*, Dec. 13, 1912.

Miscellaneous

The Future of Electricity.—Some further interviews with prominent French and Italian electrical engineers. Barbillion discusses some problems of electrical training in French schools and universities. Riccardo Arno predicts that central stations will be forced more and more to make a charge for extra-phase currents; Arno's method of accomplishing this has been already adopted by a number of stations in Italy. Marius Latour thinks that new principles of dynamo-electric machinery can hardly be expected, as every possible type seems to have had its chance of being invented. But improvements will be made in mechanical respects, etc. Really great progress is to be hoped from the laboratories of the physicists and the chemists. Grosselin thinks that power transmission by cables is bound to increase with the length of alternating-current transmission systems.—*La Lumière Elec.*, Dec. 21, 1912.

Book Review

Power Loss Calculator for Electrical Conductors. Devised and published by Ralph U. Fitting, Pine and William Streets, New York City. 1912. Three pages and two calculators. Price, $5.

A handy calculator for the use of engineers in calculating transmission-line problems. The calculator itself is in two parts, the first of which is based on the assumption that the line-charging current or electrostatic capacity effect is negligible. The known quantities in the problem are kilowatts to be delivered, length of line, volts between phase wires at receiving end, and power-factor of load; the calculator determines the per cent of power lost in single-phase, two-phase or three-phase circuits of copper, aluminum or copper-clad steel. The second portion of the calculator is for determining the correction to be applied to the result obtained in the first instance on account of neglecting the line-capacity effect. In most cases this calculator will determine the line loss to within 1 per cent of loss. In a specific case the following results were obtained: Given a three-phase, 50-cycle, 111,100-volt line, with 250,000-circ.-mil conductors spaced 10 ft. between adjacent phases, all in one plane, a load power-factor of 0.921 lagging and a product of 2,420,000 kw-miles (kilowatts delivered multiplied by length of line in miles), then the computed loss will be 4.73 per cent, the calculator loss uncorrected 5.10 per cent, the capacity correction 0.57 per cent, and the calculator loss corrected 4.53 per cent. This calculator may be regarded as very useful for making preliminary plans or checking final calculations.

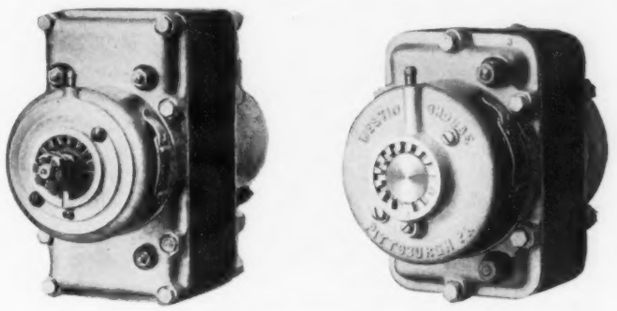
New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Starting, Lighting and Ignition Systems for Automobiles

The Westinghouse Electric & Manufacturing Company has entered the accessories market with starting, lighting and ignition outfits. The equipments so far announced are starting motors, lighting generators, combined ignition and lighting generators, and combined starting and lighting motor-generators—all 6-volt systems. For starting and lighting one motor-generator is used, and for ignition and lighting one generator and one ignition coil. All timing and distributing parts are contained in the generator, thus simplifying both the electrical and the mechanical connections.

A feature of the motors and generators is the heat-resisting compound in which all windings are baked. This compound cements the windings together and prevents them vibrating and jarring loose—and the compound, it is claimed, will not soften even at 250 deg. Fahr. Oil, gasoline, water and alcohol are also said to have no effect upon this compound. The generators operate in connection with a storage battery, which supplies energy when the engine is running at low speeds and when the car is idle. By an arrangement of the generator winding the battery is charged at all running speeds when lamps are not burning, and when the lamps are burning the generator supplies the energy for the lamps and in addition charges the battery above the balancing speed. The arrangement is said to be such that the battery is at no time charged at an excessive rate. Regulation of battery charging is accomplished by the generator itself and without the use of any relays or solenoid-operated regulators. The system is self-regulating and no adjustments are necessary. The generators have wound-field coils.



TWO TYPES OF 6-VOLT DYNAMOS

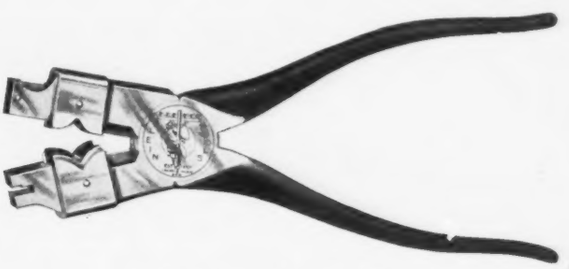
Ignition is accomplished through single-unit spark coil, operating in conjunction with timing and distributing parts on the generator. The battery, either alone or acting with the generator, furnishes continuous energy. The timer or interrupter gives automatic spark advance, and also increases the period of contact as the speed increases to make the spark uniform regardless of speed.

The Westinghouse starting motors are designed with a view to minimizing the discharge of the battery during starting. This is done by adapting the power of the motor to the requirement that it turns the engine over as one would do in cranking by hand. This takes considerably less power than would be required to spin the engine unnecessarily at high speed, and makes possible the use of a lighter battery and a lighter charging generator because of less capability for charging.

The motors and generators have ball bearings and steel shafts and frames. They are entirely inclosed and thus are dust-proof and liquid-proof. Lightness of weight is secured by a compact arrangement and design of the parts. Starting, lighting and ignition switches, meters and wiring details are furnished complete with standard equipments by the manufacturing company.

Wire-Skinning Pliers

A tool for removing insulation from wire has been placed on the market by Mathias Klein & Son, 562 West Van Buren Street, Chicago. Referring to the illustration, it will be noted that there are knives on both sides of the tongues for cutting the insulation, that another knife splits the insulation lengthwise of the wire and finally that the end of the jaws is cross-hatched to give a good grip in pulling off the insulation. Another knife is provided for scraping the wire, if necessary, and there are a slot for bending loops in ends of wires and a knife for side cutting. At present these wire-skinning pliers are manufactured only in a size for use with No. 14 wire.



WIRE-SKINNING PLIERS

Electric-Lighting System for Automobiles

To avoid the difficulties arising from the use of small and delicate parts in automobile lighting the Rushmore Dynamo Works, Plainfield, N. J., have designed a system of utilizing the property belonging to iron wire of increasing its electrical resistance considerably at a temperature slightly below red heat. The voltage and current are in proportion up to about 10 amp, indicating that the resistance is constant; but above 10 amp it suddenly requires a largely increased voltage for each additional ampere of current.

The first and most primitive method for utilizing this property of iron wire was simply to insert the iron coil as an automatic rheostat in the main circuit. This arrangement allowed the dynamo voltage to rise unchecked with the speed and the surplus output was absorbed in heat by the iron coil. Aside from its wastefulness, this system gave very imperfect regulation. A slight step in advance was made by connecting the shunt-field coil beyond the iron coil, thereby holding the voltage at the terminals of

the field coil fairly constant. This did not give a constant field, but a self-weakening field.

The solution was found in supplementing the main-shunt field coil with a bucking coil arranged as a shunt around the iron "ballast coil." The bucking coil opposes the main field coil but is not under any condition quite so strong as the latter. When the ballast coil is cold it practically short-

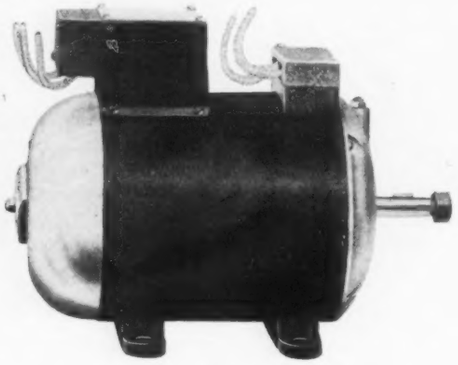


FIG. 1—THE DYNAMO COMPLETE

circuits the bucking coil, so that the effect of the latter is negligible and the main-shunt coil has its full effect. Thus at low speeds the dynamo acts practically like an ordinary shunt dynamo and builds up an effective output at the lowest practicable speed. When, however, the critical speed and temperature of the ballast coil are reached the resistance of the latter increases rapidly, thus forcing the excess current through the bucking coil and decreasing the excitation due to the main-field coil.

When the parts are properly proportioned it will be found that the dynamo will generate a small current of the necessary voltage for charging even at 200 r.p.m., and it attains its normal or critical output at about 600 r.p.m. From this speed to the highest the rise in output when connected to the storage battery is trifling. At the highest speeds the field excitation is said to be only one-sixth of what it would be without the bucking coil.

A 28-lb. dynamo, it is said, operates at an output of about 12 amp, which may rise to 14 amp at maximum speed. A larger size, weighing 43 lb. and intended to run at engine speed, develops about 15 amp normally and 16

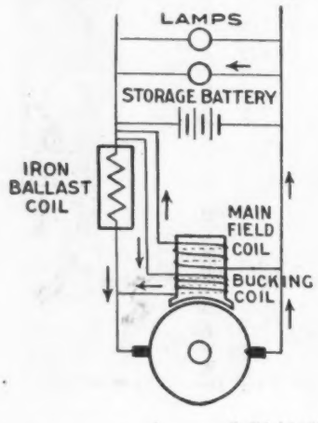


FIG. 2—CIRCUIT DIAGRAM

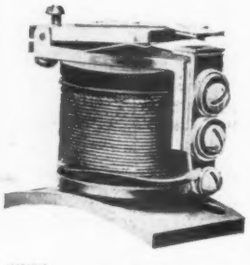


FIG. 3—AUTOMATIC CUT-OUT

to 18 amp maximum. These weights include the cut-out. The usual automatic cut-out is provided to disconnect the dynamo from the battery at speeds too low for charging. The ballast coil is mounted on the dashboard in connection with the head-lamp switch. Closing the head-lamp switch also puts the ballast coil in circuit; opening it disconnects the ballast coil, so that the entire output of the dynamo has to pass through the bucking coil. This intensifies the action of the latter so much that the output is held down to an average of 3 amp, which takes care of the small lamps and delivers a small current to the battery, thereby always keeping the latter charged.

It is claimed that owing to the large output of the dynamo daylight charging (other than the small constant 3-amp current) is unnecessary. Operating the dynamo when light is wanted produces automatically at ordinary driving speeds all the energy required. As a lamp takes about 1 amp to every 6 cp, head lamps as large as 30 cp each will take only 10 amp for the pair, leaving a sufficient margin to supply the side and tail lamps and still deliver a

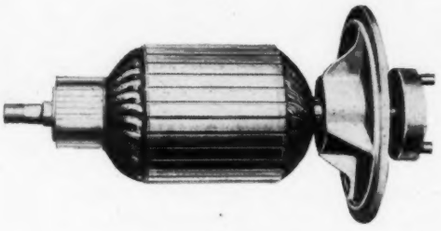


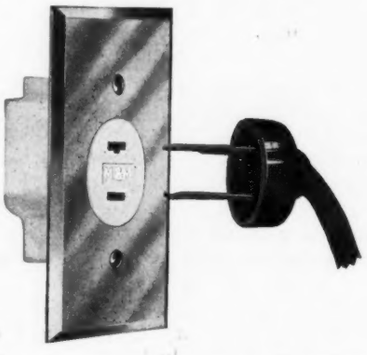
FIG. 4—SLOW-SPEED ARMATURE

small charge to the battery. The fact that daylight charging is not necessary is an additional advantage, as it relieves the owner of the responsibility for seeing that his battery is kept charged.

Flush Receptacle

A receptacle which is interchangeable in that it provides for the use of either a surface plug or a polarity plug in connection with it has recently been put upon the market by the Machen & Mayer Electrical Manufacturing Company of Philadelphia, Pa. The receptacle, an illustration of which is shown herewith, fits flush with the wall plate which is used to give a pleasing finish and to cover the aperture containing the wall box. The receptacle is 1 3/16 in. deep, allowing room for wiring in a shallow wall box, and it is said that it is substantial in construction and neat in appearance.

It is further stated by the makers that the receptacle may be installed regardless of the type of plug to be used and that it may be wired without removing the porcelain cap. The internal construction has received special attention and has been so arranged that arcing across the con-



FLUSH RECEPTACLE AND PLUG SWITCH

tacts even on high voltages is prevented. A polarity plug in connection with this flush receptacle has been found to be especially adaptable for use with small motors, heating apparatus and the like, and for laboratory and experimental work where the polarity must not be reversed. The receptacle fits standard switch boxes and may be had in practically any finish.

Sectional Conduit System for Steam Pipes

The Berwind-White Coal Mining Company is one of the largest operators in the bituminous field, and in many respects its most interesting operations are in and near Windber, Pa. This town has a population of 12,000 and is situated high in the mountains not far from the city of

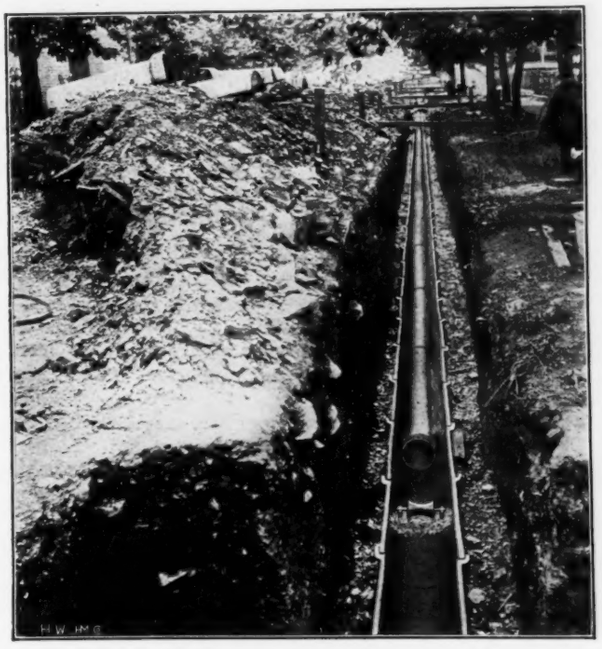


FIG. 1—LOWER HALF OF SECTIONAL CONDUIT WITH STEAM PIPES PARTIALLY INSTALLED

Johnstown. The municipality is practically owned by the coal company and allied interests.

Some years ago the Windber Heating Company was formed and a large power house was built at the entrance of one of the coal mines. This plant furnishes energy for lighting and motor service in the mines and for a large portion of the town and also steam for residence heating. At the present time the company is under contract to supply heat for 58,000 sq. ft. of radiation. In all the early installations the piping was insulated with wood covering. About a year ago one line was opened up and what was left of the wood covering was removed and sectional conduit substituted. This proved so satisfactory that the company recently replaced over 2000 ft. of steam line with sectional conduit, making a total of 3325 ft. of this system.

The recent installation, of which two views are shown, is an 8-in. main line, running from the power house up a steep hill and down a grade to the heart of the town, where it connects to the branch mains. There is no return line on this system, live steam being carried into each building at a low point, so that the return will flow back into a trap, from which it is allowed to go to waste.

Several difficult conditions had to be met with, such as the line passing through coal veins and hard pan, through which surface water containing sulphur percolated, soaked through the wooden protection and corroded the steel pipes. Consequently it was necessary to remove a considerable quantity of pipe, although it had been in place only three years. In laying this pipe line it was found necessary to cross under the gutter of a roadway which carried mine water containing a large percentage of sulphur. In laying the new conduit and pipe at this point the course of the steam was temporarily diverted while the conduit was laid across its path. A concrete dam was constructed in the gutter with the conduit embedded in it. This prevented the backfilling from washing away, securely held the conduit in line and kept it free of danger from sulphuric water.

As originally laid the pipe was allowed to take the curvature of the ditch, with unnecessary strains placed on joints, resulting in their leaking. In laying the new system care was taken to secure the correct grade. A ditch was dug 3 ft. wide and to the necessary depth. In the bottom of the ditch a channel 9 in. deep and 12 in. wide was made. In this was laid a sub-drain 6 in. in diameter, the bottom of which was covered with 6 in. of crushed stone of rather coarse grade. Upon this was laid a layer of fine chip stone, to form a fairly even bed for the bottom half of the tile conduit.

At every fifth section of tile was a supporting tee, with the bell of the branch down and the base filled to the flow line of the conduit with rich concrete, as will be noted in Fig. 1. In this concrete were set roll frames of the proper height. These frames are designed to carry the entire weight of the pipe and permit it to move under expansion and contraction without placing any strain on the tile conduit.

The steam pipe was then laid and the expansion joints were placed in the line in manholes at proper intervals. For testing purposes the pipe was then subjected to a hydraulic pressure of from 20 lb. to 60 lb., according to the steam pressure to be carried in the line where the test was made.

The top halves of the conduit were then placed in position, the longitudinal joints being well washed with neat cement mortar, and the bell joints were cemented to insure their being watertight.

Asbesto-sponge filling was packed in the conduit all around the steam pipe, as shown in Fig. 2, after each top section had been secured in place. Crushed stone of medium size was filled in until the bells of the second half were covered with 3 in. of stone. Then the ditch was filled up and tamped.

The manholes were made with 13-in. concrete foundation walls to a height even with the top of the lower half of the conduit. The conduit was brought through the man-

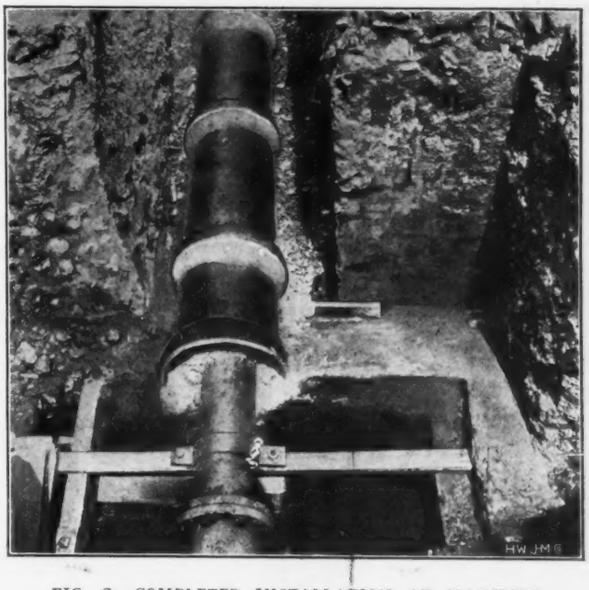


FIG. 2—COMPLETED INSTALLATION AT MANHOLE

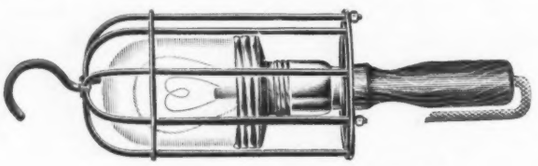
hole walls, so that the edges of the tile were flush with the inside of the walls. In order that the tile should have bell ends in the manholes, unions were used in laying the first sections on the down-grade side of all manholes. Over these concrete foundation walls brick walls were built and brought in at the top to the proper size to receive the manhole plates. Wherever the tile entered the manholes the

pipes were covered with sleeves of sectional asbesto-sponge felted pipe covering and the openings around them were closed with a shutter.

Aside from its simplicity and the facility afforded for its rapid installation, these sectional conduits, which are made by the H. W. Johns-Manville Company, New York, are said to be impervious to water, dampness and acids. Being made from a special combination of stoneware, clay and other ingredients, they form a particularly durable protection for underground steam pipes subject to corrosive action from chemicals. An additional advantage found in the use of these conduits is that, owing to their method of construction, the weight or movement of pipes cannot injure the conduit. It can be opened up for inspection or removed and relaid without damage to the piping.

Vapor-Proof Portable Lamp Guard

The McGill Manufacturing Company, of Valparaiso, Ind., is putting on the market a vapor-proof, water-tight portable guard for use in breweries, tanneries, gas plants, cement plants and other places where a guard of this character is needed and there is danger of short-circuiting. The unit is provided with a glass globe which screws tightly over the lamp and is in turn protected by a wire guard.



VAPOR-PROOF PORTABLE LAMP GUARD

An Electric Tachometer

There are many operations in which it is desirable to have permanently connected to an engine or machine an accurate speed indicator which will show at a glance the speed at which the machine is operating or will keep a continuous record of speed throughout the period of operation. The Brown Instrument Company and the Keystone Electrical Instrument Company of Philadelphia, Pa., are placing on the market an electric tachometer which it is said will perform these duties in a satisfactory manner.

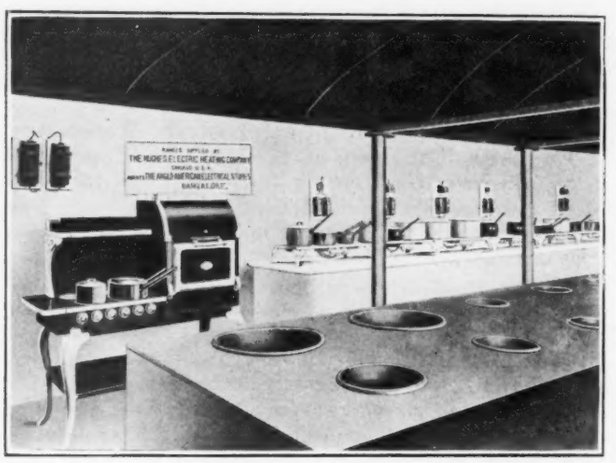
ELECTRIC TACHOMETER AND SPEED RECORDER

The instrument consists of a small generator, designed for use with this tachometer and generating 25 volts at 1000 r.p.m. On account of this voltage generated, an instrument which is dead-beat in operation can be supplied. The instruments have unusually high resistance, exceeding 3000 ohms in each, so that the length of leads connecting the magneto and the indicating instrument has no effect on the readings. One, two or three instruments may be connected to the same generator without affecting the indications. This high-resistance feature is advantageous, for oftentimes after the generator and one indicating instrument have been installed it is desirable to place a recording instrument in an office or at another convenient point, and this can be connected to the generator without recalibrating the instrument.

With many machines operation at a certain speed is necessary to produce the best results. For instance, in large machine tools it is desirable to know the cutting speed, in blast furnace plants the number of cubic feet of air per minute blown into the furnace is checked from the engine speed, and in practically all testing laboratories speed is an important measurement. It is claimed that this electric tachometer will bring all these operations under more accurate control.

Electric Cooking Installation in a Maharajah's Palace

Electric stoves and other cooking utensils made in the United States have found their way into high social circles in India, and appear to be appreciated there. The accompanying illustration shows the kitchen in the palace of the Maharajah of Mysore, where electric cooking appliances made by the Hughes Electric Heating Company of Chicago are installed. In the foreground is seen a table equipped with a charcoal stove, used before the electric range and other utensils were installed. At the left is a four-hole electric range. The "griddles" are equipped for three-heat intensities, consuming at maximum 880 watts, at medium 440 watts and at low heat 220 watts. The oven has two three-heat units, located at top and bottom. The range has a broiler attachment and is provided with a warming closet and a shelf extending the full length of the stove underneath the oven. Other electric cooking appliances in the Maharajah's installation are six three-burner hot plates, four two-burner hot plates, two table stoves and six self-contained ovens. All were made by the Hughes company.



ELECTRIC COOKING INSTALLATION IN INDIA

From a letter written by Mr. C. F. Beames, chief electrical engineer for the Mysore government, it appears that the appliances have made a decided "hit."

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Purchase Control of Wilmington & Philadelphia Traction Company.—The National Properties Company of Pittsburgh has acquired a controlling interest in the Wilmington & Philadelphia Traction Company through purchase of a large block of that company's common stock. The purchase was made through Messrs. H. B. Hollins & Company, of New York, and Messrs. Newburger, Henderson & Loeb, of New York and Philadelphia, together with Messrs. Scott & Company, of Wilmington. This gives to the National Properties Company control of the electric lighting business of Wilmington, Del., and of the street railway systems in that city and in Chester, Pa. There is also a connection between these street railway lines and those in Philadelphia. The capitalization of the Wilmington & Philadelphia Traction Company will not be enlarged. In addition to this recent acquisition, the National Properties Company controls the Pittsburgh City Light & Power Company and several water companies in the West. Its president is Mr. Van Horn Ely, of Pittsburgh; Mr. W. F. Havemeyer, of Philadelphia, is vice-president, and Mr. B. N. Busch, of Messrs. H. B. Hollins & Company, New York, secretary-treasurer. Mr. H. D. Anderson is auditor. The company has offices at 15 Wall Street, New York, and in the Commonwealth Building, Pittsburgh. Mr. Ely is to be president of the Wilmington & Philadelphia Traction Company, succeeding Mr. Oscar T. Crosby, who has sold his interest in the company, has resigned and expects to go abroad at an early date for an extended tour. Mr. T. W. Wilson, now assistant to the president, will become vice-president and will remain in active local control of the Wilmington company. No immediate extensions or improvements are contemplated by the purchasers, according to Mr. Ely, who stated this week that the properties are in excellent condition.

Western Electric Prize Salesmen in Conference.—Some thirty-five of the prize salesmen of the Western Electric Company and fifteen of the general office men took part in a conference held in Chicago from Jan. 6 to 11. The prize salesmen are the men who make the best records at the eighteen district offices. The contests are determined quarterly, and badges of different colors indicate the number of contests won. Thus a blue badge designates a four-time winner, a red badge three successes, and so on. The number of badge winners up to Jan. 1 in the Western Electric organization was eighty-nine. Salemen who had not been winners in prize contests before March 1, 1912, were eligible to attend the Chicago conference and inspect the Hawthorne factory. The program of the week included talks on various subjects by men inside and outside of the organization, presentation of prize badges, inspection of the shops and various entertainment features. On the night of Jan. 9 the Hawthorne Men's Club gave a banquet at the Hotel La Salle to which the prize salesmen and other visitors were invited. This banquet is said to have been the largest ever held in Chicago, 988 men sitting down to it. On the following evening there was a conference banquet, at which a number of prominent Western Electric men were in attendance, including Messrs. W. P. Sidley, vice-president; Gerard Swope, general sales manager; H. F. Albright, general superintendent; F. V. Bennis, supervisor; O. D. Street, general telephone sales manager; E. W. Rockafellow, general supply sales manager; F. A. Ketcham, central district manager, and H. L. Grant, Chicago sales manager. One interesting statement made during the conference was that the Western Electric Company did the largest business in its history in 1912, the sales reaching over $70,000,000.

British Telephone Award Followed by Stock Decline.—Sitting as a court of arbitration, the British Railway and Canal Commission, consisting of five judges of the High Court, rendered a decision on Jan. 13 that the government shall pay $62,576,320 to the National Telephone Company for its system, which was taken over by the Post Office Department on Jan. 1, 1912. All of the telephones in the British Isles, 648,000, passed into the hands of the State through this transfer. The National company originally demanded $105,000,000 for its interests, but this figure was reduced by many millions through compromises during the trial, which lasted seventy-three days. During the trial an agreement was reached as to the value of the plant, this sum being $51,568,825. More than 600 men were employed for eighteen months at a cost of $1,250,000 in making an inventory of the properties. Following agreement as to the value of the plant, it became necessary for the court to determine what additional amounts should be paid to the company. It had been expected that a total award of between $80,000,000 and $90,000,000 would be made to the company, so that the judgment of the commission for about $62,000,000 was followed by a thirty-two-point decline in the quotations of the company's stock. This fell from 141, at which it had stood for some time, to 109. At times last year the price was as high as 162. It has been stated repeatedly that since the government took over the telephones the service has been exceedingly unsatisfactory.

Will Erect a Steam Generating-Station Near Toledo.—Control of the Maumee Valley Electric Company of Maumee, Ohio, and of the Suburban Light & Power Company, of Perrysburg, Ohio, has been obtained by the Crawford interests, of New York, which organized the Auglaize Power Company in 1911. The Defiance (Ohio) Gas & Electric Company is controlled by the same interests. A steam generating station, to cost about $500,000, is to be erected near Toledo and energy from this station will be supplied to towns between Defiance and Toledo. W. P. Wallace, who has been general manager of the Auglaize company, will be manager of all the properties. H. L. Crawford, of H. L. Crawford & Company, New York, has been chosen president of the Auglaize Power Company, while E. L. Crawford, of Crawford, Patton & Cannon, New York and Philadelphia, heads the Defiance Gas & Electric Company. Eugene Reinfrank, general counsel for the companies, is president of the Valley Light & Power Company, but its organization has not been completed yet. A reference to the hydroelectric developments of the Auglaize Power Company appeared in these columns May 18, 1912.

Copper Down to 17 Cents a Pound.—As had been expected since publication of the December statement of the Copper Producers' Association, showing an increase of nearly 20,000,000 lb. in surplus stocks as a result of refusal by consumers to pay the high prices demanded by the selling interests, concessions were made this week by the larger domestic producers. Many of the smaller selling interests offered electrolytic copper last week under 17¾ cents a pound, the price which has been maintained since June, and on Jan. 14 quotations below that figure were made by the larger selling interests in the market. By the end of the day electrolytic was available at prices ranging between 17¼ cents and 17 cents a pound, and offerings as low as 16¾ cents were made by second hands. Actual sales were in small volume, the general attitude on the part of consumers being to hold off until it is determined whether still lower levels will be reached.

Oro Electric Corporation Seeks Franchise in Stockton.—The State Railroad Commission of California has set Feb. 11 for a hearing upon the application of the Oro Electric Corporation of San Francisco for permission to engage in the electric-service business in Stockton, Cal. Service in that city is now furnished by the Western States Gas & Electric Company.

Electric Bond & Share Company Financing.—Directors of the Electric Bond & Share Company at a meeting held January 14 authorized the issuance of $1,500,000 additional preferred stock and $1,500,000 additional common stock. They also voted an extra cash dividend of $1,500,000 to the holders of the company's common stock, payable to holders of record at the close of business on January 14, 1913. The $1,500,000 preferred stock will be offered for subscription at par and accrued dividend to holders of preferred stock of record at the close of business on January 14, 1913. The common stockholders have agreed to purchase at par and accrued dividend so much of such preferred stock as shall not have been subscribed for by preferred stockholders on or before February 1, 1913. The $1,500,000 common stock will be offered for subscription at par and accrued dividend to holders of common stock of record at the close of business on January 14, 1913. With the issuance of the new stock the company will have outstanding a total of $5,000,000 preferred stock and $5,000,000 common stock. The regular quarterly dividend of 1½ per cent on the preferred stock, payable February 1 to stockholders of record January 27, and the regular quarterly dividend of 2 per cent on the common stock, payable January 16 to stockholders of record January 15, have also been declared.

General Gas & Electric Company's Business Is Increasing.—Improvement continues to be shown each month in the returns of the General Gas & Electric Company, which was formed last year by W. S. Barstow & Company, 50 Pine Street, New York, as noted in these columns July 6, 1912, to take over and operate public utilities in Ohio and Vermont. In the twelve months ended Nov. 30, 1912, gross returns from these properties showed a gain of about $92,600, as compared with returns in the corresponding period last year. Net earnings increased by about $36,500 and the surplus for dividends by some $32,250. The company is extending its transmission lines for about 20 miles in Vermont so as to serve a large number of slate quarries with electrical energy. There are some seventy-five quarries in the region, from which a number of contracts have already been secured. A vigorous campaign for the business of the others is now in progress. Substantial increases in the earnings of the Northwestern Ohio Railway & Light Company, which is controlled by the General Gas & Electric Company, are expected during the present year. An increase of at least $10,000 in passenger and freight revenues by June 30, 1913, is regarded as probable by the company, and a gain of some $30,000 in revenue from lighting business is also considered likely.

Seek to Foreclose Susquehanna Power Mortgage.—Action to foreclose the mortgage on the property of the Susquehanna Power Company, which has water rights on the lower Susquehanna River, was begun last week by the Girard Trust Company of Philadelphia, trustee under the mortgage. It is desired to sell the property. The bill was filed by Stevenson A. Williams, of Belair, and John H. Barnes, of Philadelphia. This action was taken by the trust company because of the pressure of bondholders of the power company for interest and because the efforts which have been made to re-finance the company have failed thus far. The Susquehanna Power Company went into the hands of receivers last July, George R. Willis, of Baltimore, and Stevenson A. Williams, of Belair, being appointed. It is understood that after the business of the present company has been closed another attempt will be made to organize a power company along ideas similar to those which governed the Susquehanna company.

Republic Railway & Light's New Station Ready for Operation.—The new station of the Republic Railway & Light Company at Lowellville, Ohio, has been completed and will be placed in active operation within the next week or so. Part of the equipment in the new station was used to help carry the peak load on the company's system during the holiday season. Energy will be furnished from this station to the electric railway and lighting companies in Youngstown, Ohio, New Castle and Sharon, Pa., and to a number of smaller comunities in that section. The station contains two 9375-kva turbine units, which will generate energy at 2300 volts. This will be transmitted at 13,000 volts. The plant will be run condensing, with surface condensers. The engineering and construction work in connection with the plant has been done by the Stone & Webster Engineering Corporation.

Puget Sound Traction, Light & Power's Report.—A statement of its earnings for 1912, with an estimate of those for December, has been issued by the Puget Sound Traction, Light & Power Company. This company, as was noted in the *Electrical World* Jan. 13, 1912, was formed early last year under Maine laws, as a consolidation of all the important public-utility properties operated by Stone & Webster in the Puget Sound district, and included the Pacific Coast Power Company, Seattle Electric Company, Seattle-Tacoma Power Company, Puget Sound Electric Railway, and the Whatcom County Railway & Light Company. The company was reincorporated later in the year, as was noted July 6, under Massachusetts laws, its stock being non-taxable in that State. The financial statement shows gross returns of $8,377,883; net earnings, $3,502,788; interest charges, $1,749,569; sinking fund charges, $223,887; net income, $1,529,392; preferred dividends, $589,392; common dividends, $742,176, and a balance for addition to the surplus of $197,764.

Acquires Nebraska Properties.—The Continental Gas & Electric Corporation, which was recently incorporated under Delaware laws, has taken over the water, gas and electric properties at Beatrice, Plattsmouth and York, Neb., and those at Red Oak and Shenandoah, Ia. The new corporation has taken over the bonds and stocks of the companies controlling these properties. The Continental Gas & Electric Corporation has an authorized capitalization of $5,000,000 common, $1,000,000 preferred and $5,000,000 5 per cent first-lien collateral trust bonds. There is $1,250,000 common stock, $300,000 of the preferred stock and $685,000 of the bonds outstanding. The bonds issued have been sold to P. W. Brooks & Company, of New York.

American Light & Traction to Increase Capital.—A special meeting of the stockholders of the American Light & Traction Company has been called for March 17 to vote upon an increase in the authorized common stock from $15,000,000 to $40,000,000. There is now about $11,426,200 common stock outstanding and also $14,236,200 of the $25,000,000 authorized 6 per cent cumulative preferred stock. It is understood that the proposed increase in common stock foreshadows continuance of the company's policy of paying quarterly dividends of 2¼ per cent in cash and 2½ per cent in common stock for some time to come.

Otis Elevator Company Had a Good Year.—Earnings of the Otis Elevator Company in 1912 were the largest in the history of the company. Gross business increased about 10 per cent over that in the preceding year, and net earnings also showed a satisfactory gain. The company is now paying dividends at the rate of 6 per cent on the preferred stock and 4 per cent on the common. W. D. Baldwin, president of the company, who recently returned from a European tour, considers that the outlook abroad for 1913 in his business is exceedingly bright.

Northern Ohio Traction & Light Company's New Plant Nearly Ready.—Work is going forward rapidly on the Northern Ohio Traction & Light Company's new 38,000-kw station at Cuyahoga Falls. Earnings of the company are improving, the gross returns for 1912 (with December estimated) being $2,999,400, as compared with $2,694,024 in 1911. Net earnings are placed at $1,289,425, as against $1,201,498, and the surplus for the stock at $763,863, which compares with $670,466 in 1911.

Merges Missouri Utilities.—The Missouri Public Utilities Company, which has filed articles of incorporation at St. Louis with a capital of $1,000,000, has taken over the public-utility properties in Charleston, Sikeston, Illmo and Fornfelt, Mo. It is stated that negotiations for the acquisition of several other properties in the southeastern part of the State are in progress.

Upper New York State Telephone Companies Absorbed.—The New York Telephone Company has advised the Public Service Commission for the Second New York District that it has purchased the Hamilton (N. Y.) Telephone Company and the Citizens' Standard Telephone Company, which operates in Phœnicia, Rosendale, Kingston and Shokan, N. Y.

Protective Committee for Bullock Electric Preferred Stockholders.—Charles L. Harrison, R. Clifford Shinkle and George D. Eustis have been selected as a stockholders' committee by the holders of the preferred stock of the Bullock Electric Manufacturing Company of Cincinnati, Ohio, to co-operate in the protection of their interests in the reorganization of the Allis-Chalmers Company, which hoids a controlling interest in the Bullock company through the purchase of the common stock. The Allis-Chalmers Company paid the 6 per cent dividend on this stock under a guarantee until it became financially involved. The receiver also made payments, but notice has been given that no further payments will be made. There is $1,170,000 of this stock outstanding. George Bullock, of New York, one of the heaviest holders of the preferred stock, will co-operate with the Cincinnati stockholders and signatures will be secured as rapidly as possible to the agreement.

American Telephone & Telegraph Issues $67,000,000 Bonds.—The directors of the American Telephone & Telegraph Company voted on Jan. 14 to authorize an issue of $67,000,000 twenty-year 4½ per cent convertible bonds to be offered to stockholders for subscription at par and interest in the proportion of 20 per cent of their holdings of stock. The bonds will be dated March 1, 1913. They will be convertible into stock at $120 per share between March 1, 1915, and March 1, 1925. President Vail in a circular to the stockholders says that the issue is to provide for construction and other corporate requirements and that it is expected that the earnings from the employment of the proceeds of the bonds will meet the additional charges necessitated, so that the surplus earnings of the company will not be disturbed.

Bell Telephone Gains.—In the eleven months ended Nov. 30, 1912, gross earnings of the Bell telephone system in the United States, comprising those of the American Telephone & Telegraph Company and associated holding and operating companies in this country, not including connected independent or sub-licensee companies, were $181,411,083, as compared with $163,686,329 in the corresponding period of the previous year. Total expenses were $128,599,603, as compared with $116,720,188, leaving net earnings of $52,-811,480, as against $46,966,141. Surplus earnings, after deduction of interest and dividends (paid for nine months and estimated for two months), were $12,998,234, as against $10,827,805 in the eleven months ended Nov. 30, 1911.

Detroit Edison to Issue Additional Common Stock.—Directors of the Detroit Edison Company are to meet shortly to decide upon the amount of additional common stock to be issued for financing the extensions and improvements made to its properties last year. Between $2,000,000 and $3,000,000, it is understood, will be issued and offered to stockholders at par after Feb. 1, so that holders of the company's debenture bonds which are convertible into stock at par on that date may participate.

Annual Meeting of Doherty Operating Company.—At the annual meeting of the Doherty Operating Company this week the retiring directors were re-elected, and they organized subsequently by re-electing the former officers. Henry L. Doherty & Company have taken additional space in their present headquarters at 60 Wall Street, New York, and now occupy the entire thirteenth, fourteenth and fifteenth floors and a part of the twelfth floor.

Marlboro (Mass.) Company to Issue Stock.—Stockholders of the Marlboro (Mass.) Electric Company have voted to apply to the board of Gas and Electric Light Commissioners for authority to issue 1300 shares of new stock. The proceeds are to be used for refunding floating indebtedness incurred by the company in paying for additions and improvements.

Paducah (Ky.) Light & Power Directors Re-elected.—At a recent meeting of the stockholders of the Paducah (Ky.) Light & Power Company and the Paducah Traction Company the old directorates of these corporations were re-elected.

Appalachian Power Extending Its Lines.—The Appalachian Power Company, Bluefield, Va., has completed the transmission line between Pulaski and Radford and is now supplying energy over it.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Jan. 8	Jan. 15
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	1¼*	1⅛
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	5*	4½
Amalgamated Copper	153,887,900	1	Q	77½	72½
American Tel. & Tel.	334,712,300	2	Q	139½	134½
Electric Storage Battery,c.	16,074,425	1	Q	53¼	53
General Electric	77,726,700	2	Q	185	182*
Mackay Cos., c	41,380,400	1¼	Q	84	85
Mackay Cos., pf.	50,000,000	1	Q	68	67⅛
Western Union Tel.	79,943,400	¾	Q	75	71
Westinghouse, E. & M., c.	31,685,300	1	Q	78	73¾
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	121¼*	121½*

*Last price quoted.

NEW YORK METAL MARKET PRICES

	Jan. 7 Bid.	Jan. 7 Asked.	Jan. 14 Bid.	Jan. 14 Asked.
Copper:				
Standard, spot	17.00	17.37½	15.25	.....
	£ s d		£ s d	
London, standard, spot	76 7 6		69 17 6	
Prime Lake	17.60 to 17.75		16.75 to 17.00	
Electrolytic	17.55 to 17.65		16.50 to 16.75	
Casting	17.35 to 17.45		16.25 to 16.50	
Copper wire, base	19.00		19.00	
Lead	4.35		4.35	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.35		7.35	
Tin, spot	50.20		50.80	
Aluminum:				
Prompt delivery	26.00 to 26.50		25.75 to 26.25	
Future	25.75 to 26.25		25.50 to 26.00	

OLD METALS

Heavy copper and wire	16.00	15.50
Brass, heavy	10.00	9.50
Brass, light	8.50	8.00
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN JANUARY

Total tons to	Jan. 9, 3,159	Jan. 15, 12,020

Personal

Mr. Bassett Jones, Jr., is making a combined business and pleasure trip to the Panama Canal Zone. He will return to New York on Jan. 20.

Mr. Walter S. Weller, employed by the Metropolitan Electric Company, Reading, Pa., as an illuminating expert, has been appointed sales agent.

Mr. R. M. Bassett, formerly in charge of the Cincinnati office of the Murphy Iron Works, has been made manager of the company's Chicago office.

Mr. E. Holcomb, manager of the Consumers' Power Company of St. Paul, Minn., has been elected president of the Minnesota Electrical Association.

Mr. W. L. R. Emmett, of the General Electric Company, delivered a lecture on "The Electric Propulsion of Ships" in the hall of the Franklin Institute, Philadelphia, on Jan. 9.

Col. George P. Scriven, of the Signal Corps, U. S. A., has been nominated as chief signal officer by President Taft as successor to Brigadier-General James Allen, who retires next month.

Mr. D. D. Maxwell, of Milwaukee, Wis., has been appointed manager for the properties of the Central Illinois Utilities Company at Watseka, Ill., to succeed Mr. H. J. Frith, resigned.

Mr. L. A. McArthur, assistant to General Manager W. L. Davidson of the Pacific Power & Light Company, Portland, Ore., has been made local manager of the company's properties at North Yakima, Wash.

Mr. N. C. Draper, manager of the Sioux Falls (S. D.) Light & Power Company, was recently elected president of the Dakota Club, a social organization having a membership of more than 200 business men of Sioux Falls.

Mr. L. Hey Sharp, of Sydney, N. S. W., associate member of the (British) Institution of Electrical Engineers, is visiting the United States on a tour around the world by way of New York, San Francisco and Honolulu.

Mr. L. R. Krumm has been transferred from the post of electrical engineer, Signal Corps, U. S. A., to the position of chief of the radio division, Bureau of Navigation, Department of Commerce and Labor, Washington, D. C.

Mr. F. L. Hutchinson, secretary of the American Institute of Electrical Engineers, has just recovered from a mild attack of typhoid. He has returned from the hospital to his home, and is preparing to resume his secretarial duties.

Mr. Alexander McIver, formerly connected with the Westinghouse interests in New York City, has been appointed supervising engineer of the stations of the Columbus (Ohio) Railway & Light Company, succeeding Mr. F. R. Brosius.

Mr. Thomas Woulfe has resigned his position as manager of the properties of the Illinois Northern Utilities Company at Sterling, Ill., to accept a position as superintendent of power for the Marion, Bluffton & Eastern Railway at Indianapolis, Ind.

Mr. A. A. Pope, assistant general inspector of the New York Edison Company, has suffered the loss of his wife, who died suddenly on Jan. 13. Mr. Pope is well known in the lighting field and his many friends will be pained to learn of his bereavement.

Mr. F. R. Brosius, who has been supervising engineer of the generating stations of the Columbus (Ohio) Railway & Light Company, has been appointed supervising engineer of the generating stations of the Columbia Gas & Electric Company, Cincinnati, Ohio.

Mr. C. O. Pardo, who has been employed as district commercial manager for the Carolina Power & Light Company at Oxford, N. C., has resigned to enter the ministry. Mr. Pardo has been appointed pastor of the Presbyterian Church at Greenville, N. C.

Mr. H. R. Kingman, manager of the North Yakima (Wash.) plants of the Pacific Power & Light Company, has been transferred to Texas to take charge of a consolidation of plants recently acquired by the American Light & Power Company, New York.

Mr. G. F. Atwater, superintendent of the Greenwich (Conn.) division of the United Electric Light & Water Company, has been transferred to the South Norwalk division, with headquarters at South Norwalk, Conn., succeeding Mr. George F. Caffery at the latter place.

Prof. Charles F. Burgess, of the University of Wisconsin, has been awarded the Octave Chanute medal by the Western Society of Engineers of Chicago for his paper on "Electrolytic Corrosion of Iron in Concrete," read before the electrical section of that society early in 1911. An abstract of this excellent paper and the discussion following it was given in the *Electrical World* of April 6, 1911, page 827.

Mr. George P. Nichols and his brother, Mr. Samuel F. Nichols, of Chicago, who constitute the firm of George P. Nichols & Brother, were called to Grafton, Mass., last week by the death of their father, Mr. George K. Nichols, on Jan. 6, at the age of eighty-six. The elder Mr. Nichols served two terms each in the Senate and lower house of the Massachusetts Legislature, and was a commissioner to the World's Fair of 1893 in Chicago.

Mr. Oscar T. Crosby, president of the Wilmington (Del.) & Philadelphia Traction Company, has sold his interest in that company to the National Properties Company, of Pittsburgh, which has just acquired control of the Wilmington property, and has also resigned the presidency. He will leave shortly for an extended tour of Asia and Africa. Mr. Van Horn Ely, of Pittsburgh, president of the National Properties Company, is his successor.

Mr. Joseph Bradley Murray, assistant engineer of the Illuminating Engineering Bureau of the New York Edison Company, has been appointed assistant to General Manager W. F. Wells of the Edison Electric Illuminating Company of Brooklyn. Mr. Murray is a graduate of Yale and has served an apprenticeship in the various departments of the New York Edison Company. He is a son of Mr. Thomas Murray, vice-president of the latter company.

Mr. Philip S. Dodd, formerly connected with the *Electrical Review* and more recently director of the commercial development department of the National Quality Division of the General Electric Company, has been appointed secretary-treasurer of the Society for Electrical Development, Inc., New York. Mr. Dodd has severed his connection with the National Quality Division of the General Electric Company to devote all his time to his work with the Society for Electrical Development.

Mr. J. M. Wakeman, formerly general manager of the McGraw Publishing Company, whose return to America was noted in these columns on Nov. 30, has been appointed general manager of the Society for Electrical Development, Inc., New York. The object of the Society for Electrical Development is to promote the use of electrical energy and to further the interests of lighting companies, manufacturers, jobbers, contractors and dealers through a vigorous co-operative campaign of publicity, etc., to guide which Mr. Wakeman is eminently fitted.

Obituary

Mr. William H. Hornberger, electrical engineer and inventor, died at his home in Lafayette, Ind., Jan. 3. Mr. Hornberger was identified with the early electrical development of Elkhart, Ind., and for many years was engaged in the manufacture of transformers in Lafayette.

Mr. James Whiting Johnson, district manager in Chicago for the General Electric Company, died of pneumonia, after a short illness, on Jan. 14, at his home in that city.

JAMES W. JOHNSON

Mr. Johnson was born in Waverly, N. Y., Dec. 3, 1862, and was the son of the Rev. David Johnson, a Presbyterian clergyman. He had lived in Chicago since boyhood and was a student at the Hyde Park High School. He began his business career as an office boy for the Bell Telephone Company in 1878, being associated then and for many years thereafter with Mr. B. E. Sunny. Mr. Johnson remained with the Bell company and its successor, the Chicago Telephone Company, until 1885. For two years thereafter he was managing partner of the firm of Johnson, Holland & Company, which was formed to exploit the storage-battery business. In 1887 Mr. Johnson became manager of the Northwestern Electric Accumulator Company, and a year later he entered the Chicago office of the Thomson-Houston Electric Company as a salesman, Mr. Sunny becoming associated with the office on the same day. With the exception of a period of about three years when he was connected with the United States Fire & Police Telegraph Company, Mr. Johnson was connected with the Chicago office of the Thomson-Houston company and its successor, the General Electric Company, until his death. In the early days he was manager of the isolated-plant department, and later he was successively manager of the lighting department and the power and mining department. Then he was made assistant district manager, and since May, 1908, when Mr. Sunny retired to become president of the Chicago Telephone Company, he had been district manager. Mr. Johnson was a quiet, unassuming man, but he possessed much reserve force and was a keen student of business conditions and tactful in his dealings with men. A widow, a married daughter and three brothers survive him. One of the latter, Mr. George B. Johnson, is manager of the Electric Shop of Chicago.

Construction

ENTERPRISE, ALA.—The City Light and Water Department expects to erect within the next three or four months 1 mile of pole line for street lamps. Weldon Thompson is superintendent of the Light and Water Department.

GADSDEN, ALA.—Final arrangements are being made by the Alabama Pwr. Co. for bringing its transmission lines into Gadsden to supply electricity generated at its plant now under construction at Lock 12, on the Coosa River. The company is securing rights-of-way for belt service lines in the city proper and for large trunk lines between the Coosa and Tennessee Rivers, which will eventually distribute 600,000 hp between Anniston, Gadsden and New Orleans.

WETUMPKA, ALA.—The Alabama Interstate Pwr. Co. is preparing plans for the construction of a second dam on the Coosa River at Lock 18, about 4 miles from Wetumpka. The second dam will make the river navigable and will cost several million dollars. Work will begin as soon as practicable after permits are granted. Plans are practically the same as for dam at Lock 12, except transmission lines. W. W. Freeman, Brown-Marx Building, Birmingham, is managing director.

GLOBE, ARIZ.—The Copper Reef Mining Co. contemplates installing a new electric station here and erecting a transmission line from San Carlos to its mine, a distance of 12 miles. The company will also install an aerial tramway upon its property.

ATKINS, ARK.—The Atkins Lumber Co. will move its hardwood sawmill, which is located 2 miles east of Atkins, into the town in about 90 days. An electric-light and ice plant will be installed in connection with the sawmill.

CAMDEN, ARK.—J. T. Gaughan, T. J. Watts and Harry Solmson, trustees of the Myer estate, have purchased the local water-works system and propose to consolidate both water and light plants. Plans are being prepared for a power station in which equipment for both plants will be installed.

HEBER SPRINGS, ARK.—Preparations are being made to build a hydroelectric power plant on the Red River, near Heber Springs, to supply electricity in this section. Bids for construction of the plant will be received about April 1. The cost of the dam is estimated at about $250,000 and that of the electrical plant at about $150,000. U. S. Bratton, of Little Rock, is interested. C. V. Smith, of Leslie, is engineer in charge.

TURON, ARK.—All bids for bonds for the proposed electric-light plant have been rejected. The proposition to issue bonds for the project will probably be submitted again to the voters. Rollins & Westover, of Kansas City, Mo., are engineers. R. A. Greeson is city clerk.

ALAMEDA, CAL.—Plans have been completed by M. C. Couchet, architect, for the wharf and pipe line to supply cold water for the new municipal electric-light plant. The plans call for a trestle to carry both water and fuel pipes about 2500 ft. out to the channel.

GILROY, CAL.—The State Raiload Commission has granted the Coast Counties Lt. & Pwr. Co., of Santa Cruz, permission to purchase the property of the local utilities company for $25,000.

GLENDORA, CAL.—Bonds to the amount of $37,000 have been voted to establish a municipal electric light and power plant. The property of the Glendora Lt. & Pwr. Co. will be taken over by the city. Extensions and improvements will be made to the system at once. Floyd G. Dessery, Hibernian Building, Los Angeles, is city engineer.

LONG BEACH, CAL.—Plans are being prepared by the Southern California Edison Co. to enlarge its auxiliary steam generating plant on the ocean front at Long Beach. The work will include an addition to the power house, doubling its capacity, and the installation of a second unit.

LOS ANGELES, CAL.—The Board of Public Works has approved the plans and specifications prepared by R. H. Manahan, city electrician, for the street-lighting system for the Gardena district of the city.

LOS ANGELES, CAL.—The City Council has practically rejected the four propositions submitted jointly by the three local power corporations to obtain control of the full supply of aqueduct power and has authorized its special committee to continue its efforts to purchase the companies' distributing systems.

LOS ANGELES, CAL.—The City Council has instructed the city attorney to draw an ordinance calling an election Feb. 11 to vote on the proposition to issue $17,600,000 in bonds to provide funds for distributing systems for aqueduct water and electric power, the improvement of the harbor and building a municipal railroad leading to the harbor.

MILL VALLEY, CAL.—An agreement has been reached between the Town Trustees and the Pacific Gas & El. Co. whereby a four-year contract for lighting the town will be signed by the board. Under the terms of the contract the company agrees to make extensive improvements in the service.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. contemplates extending its distributing system to different sections of the San Luis Rey River Valley to supply electricity for lamps and motors. Many irrigation projects are to be connected. Eugene E. Griffes is manager.

SACRAMENTO, CAL.—The City Commissioners have granted the Great Western Pwr. Co., of San Francisco, the contract for furnishing electricity for lighting the public buildings of the city for the next year, and the Pacific Gas & El. Co. the contracts for arc lamps for street lighting and for electricity for all motors in the public buildings. Awards for electroliers were held up temporarily, but will eventually be awarded to the Pacific Gas & El. Co., the lowest bidder.

TORRANCE, CAL.—The Torrance Wtr., Lt. & Pwr. Co., of Torrance, Los Angeles County, has applied to the Railroad Commission for permission to issue 200,000 shares of capital stock (par value $1), the proceeds to be used for construction purposes. Torrance has not a post office.

FAIRFIELD, CONN.—The Board of Selectmen has entered into a contract with the United Illuminating Co., of Bridgeport, for lighting the streets of the town with electricity. The streets are now lighted by gas lamps. It is expected that work on the new system will soon begin.

WILMINGTON, DEL.—A deal has been closed whereby the National Properties Co., Commonwealth Building, Pittsburgh, Pa., has taken over the control of the Wilmington & Philadelphia Traction Co., including electric railways connecting Wilmington with Chester and Media, Pa., with two lines making connection with the Philadelphia Rapid Transit Co., together with electric-lighting plants at Wilmington, Media and other towns along the Delaware River. No immediate extensions or improvements are contemplated by the National Properties Co. Van Horn Ely is president of the National Properties Co.

WASHINGTON, D. C.—The American consulate general at Buenos Aires, Argentina, has forwarded a call for tenders for electric clocks to be installed by the municipality in various localities of the city; also a translation of the provisions. Bids will be received until Feb. 10 and should be addressed to the Subsecretaria de Hacienda de la Municipalidad, Buenos Aires, Argentina. For further information address No. 10,152, the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 4 for furnishing supplies to be delivered at the various navy yards and naval stations as follows: Washington, D. C., Schedule 5114—15,000 ft. two-conductor cable. Brooklyn, N. Y., Schedule 5121—15,000 arc-lamp carbons; Schedule 5122—700 lb. copper tubing. Boston, Mass., Schedule 5117—5500 lb. phosphor-bronze wire. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 4, for furnishing supplies to be delivered at the various navy yards and naval stations as follows: Boston, Mass., Schedule 5108—three electric hoisting cranes; Schedule 5105—miscellaneous machine tools, lathes, drills, etc. Norfolk, Va., Schedule 5106—seven motors. Washington, D. C., Schedule 5107—one motor and blower. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster general, United States Navy.

CEDARTOWN, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 31, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at Cedartown, Ga. Drawings and specifications may be obtained at the above office or from the custodian of site in Cedartown.

JONESBORO, GA.—At an election to be held on Jan. 21 the proposition to issue $10,000 electric-light bonds will be submitted to a vote.

BOISE, IDAHO.—The City Council has decided to call for bids for furnishing 250 posts for cluster lamps; also for lamps and for electricity to maintain same.

ALEXIS, ILL.—The Tri-County Lt. & Pwr. Co. has taken over the property of the Alexis El. Lt. Co., which it purchased some time ago. The Tri-County Lt. & Pwr. Co. is planning to install lighting systems in Viola and Joy as soon as possible. A site has been purchased by the company in Viola on which it proposes to erect a substation.

ALTON, ILL.—The Alton Gas & El. Co. will build a new power house, to cost about $40,000.

BARDOLPH, ILL.—Rights-of-way for a transmission line between Bushnell and Bardolph are being secured by the representatives of the Central Illinois Pub. Ser. Co., of Mattoon. The company has secured locations for poles in the streets and alleys of Bardolph for the erection of transmission lines, and application will be made to the Village Board for a franchise to furnish electricity for lamps and motors here.

BETHALTO, ILL.—The Madison Lt. & Pwr. Co. has submitted a proposition to the Village Board offering to extend a transmission line from its power plant at Wood River, Ill., for $500. The company also asks for a contract for lighting the streets of the village.

COLFAX, ILL.—The Central Illinois Utilities Co., of Watseka, has applied to the Village Board for a franchise to operate an electric-light plant here. The company is said to have taken an option on the electric plant of R. N. Puett & Son.

DE KALB, ILL.—Two sample lamps are to be erected on the streets to enable the city lighting committee and the Commercial Club to make a selection of lamps to use for the ornamental street-lighting system to be installed on Main Street next spring.

DUNDEE, ILL.—The Pub. Ser. Co. of Northern Illinois, of Chicago, has submitted a contract to the Village Board offering to supply electricity for lighting the streets of the village with 50-cp tungsten lamps on a moonlight schedule, at $15 per lamp per year. The Village Boards of Dundee, East Dundee and Carpentersville are jointly considering the proposition.

FARMERSVILLE, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased the local electric-light plant, owned by Charles H. Nobbe. Martin McLean will be retained as superintendent for the present.

GALESBURG, ILL.—The City Council has refused to amend the franchise given to Weinberg Brothers to operate an electrical distributing system in the city so that they could secure power from outside of the city. Weinberg Brothers contemplated securing power from the Mississippi River Pwr. Co. at Keokuk, Ia.

GIRARD, ILL.—The City Council has sold the municipal electric-light plant to Tucker & Stowell, lessees of the Virden El. Lt. Co., for $17,000. A 25-year franchise has been granted to Tucker & Stowell.

HILLSBORO, ILL.—The Hillsboro El. Lt. & Pwr. Co. is erecting a transmission line from Hillsboro to Coffeen to supply electricity for the Clover Leaf Mining Co.

LINCOLN, ILL.—The Lincoln Wtr. & Lt. Co. in asking for a renewal of its 25-year franchise, which expires in five years, offers to furnish electricity free of charge for 25 years for maintaining the 16 ornamental street lamps about the court house square.

LOCKPORT, ILL.—The Northern Illinois Cereal Co. has requested the City Council to renew the contract between the Sanitary District of Chicago and the city of Lockport for the purpose of furnishing electricity to private concerns within the city.

PEORIA, ILL.—Bids will be opened Jan. 22 by the Peoria Pleasure Driveway and Park District for electric wiring, plumbing and heating for the proposed pavilion at South Park. Walter Murray is secretary.

VIRGINIA, ILL.—The property of the Virginia Lt., Ht. & Pwr. Co. has been purchased by the Western Utilities Co., of Chicago. The consideration is said to be $25,000. M. Yaple is secretary of the Virginia company.

BLUFFTON, IND.—Mayor Frank S. Smith in his annual message to the City Council gave his approval of the decision of the Council to make extensive improvements to the municipal electric-light plant.

GOSHEN, IND.—We are informed that contract for improvements to the municipal electric-light plant will probably be awarded before March 1.

HUNTINGTON, IND.—The establishment of a municipal electric-light plant to supply electricity for residential lighting is recommended by Mayor Milo Feightner in his annual message to the Common Council. The Mayor also cites that there is urgent need for repairs to the county street-lighting plant and suggests a consolidation of this plant with the proposed municipal lighting plant.

LAPORTE, IND.—The County Commissioners of Laporte County have granted John H. Sullivan, of Chicago, Ill., a franchise to erect transmission lines on the public highways in Hanna, Cass and Dewey Townships. Plans are being prepared by Mr. Sullivan to establish an electric power plant to serve the towns of Hanna, Lacrosse and Wanatah, also the farmers along the line. The location of the plant has not yet been definitely decided upon. Doran & Conboy, of Laporte, are local representatives.

PETERSBURG, IND.—The plant of the Petersburg El. Lt. & Pwr. Co. has been badly damaged by floods.

BURLINGTON, IA.—The Burlington Pwr. Co., which has a franchise to furnish electricity in West Burlington, has opened an office at 401 North Street, Burlington. The company will begin work at once on plans for the erection of its substation to distribute electricity generated at the Keokuk dam.

MUSCATINE, IA.—The Davenport & Muscatine Ry. Co. is planning to supply electricity to the farmers residing along the route of the interurban railway between Davenport and Muscatine.

WAYLAND, IA.—At a special election held recently the proposition to grant a franchise to D. D. Bentzinger to furnish electricity for lamps in Wayland for a period of 25 years was carried.

CANTON, KAN.—The city of Canton has engaged the Alamo Engine & Supply Co. to take charge of the construction of the proposed municipal electric-light plant. Bids for construction of the plant will be received about Feb. 20. The cost of the work is estimated at about $10,000. T. N. Frantz is city clerk.

MULBERRY, KAN.—At an election held recently the proposition to issue $45,000 in bonds for the installation of an electric-light plant and water-works system was carried. The cost of the electric-light plant is estimated at $30,000.

LAFAYETTE, KY.—The property of the Lafayette Ice & El. Co. has been purchased by Samuel Bumpus, of Lafayette.

LEXINGTON, KY.—Sargent & Lundy, Jackson and Michigan Boulevards, Chicago, Ill., have charge of the proposed improvements to the plants of the Kentucky Utilities Co., of Lexington, located in Somerset and Eminence. Detail plans have not yet been completed.

MUNFORDVILLE, KY.—The Munfordville El. Lt. Co. is planning to build an electric-light plant here, to cost about $3,000. Bids for construction of plant will be received about Feb. 1. J. O. Bright, of Munfordville, is engineer in charge.

MURRAY, KY.—The Murray Lt. Co. has announced that it will completely reconstruct its line connections as soon as the weather permits.

PADUCAH, KY.—The Board of Public Works has asked for an appropriation of $50,000 from the municipality, a portion of this sum to be expended for the installation of ornamental lamp standards in the downtown district.

MOUNT AIRY, MD.—We are informed that George W. Runkles and Emory Wagner do not propose to establish an electric-light plant, as reported in the issue of Jan. 4. They are installing an ice plant and laundry machinery.

BELLEVILLE, MICH.—The Eastern Michigan Edison Co., of Detroit, contemplates the construction of a dam and power plant in Belleville to develop about 3300 hp, at a cost of about $450,000. Upon completion of the Belleville project plants will be erected in Dexter and Delhi and the Argo dam raised about 2 ft.

BLOOMINGTON, MICH.—Negotiations are under way for the establishment of an electric-light plant. They include a contract for lighting the streets of the village for a period of ten years at a cost of $200 per year. L. E. Hawks, of Chicago, Ill., is interested in the project.

CLAYTON, MICH.—At an election held Jan. 6 the proposition to install a municipal electric-light plant was carried. Bids will soon be taken for an oil engine, generator and switchboard.

DETROIT, MICH.—The Dresden Brick Co., recently incorporated, is reported to be in the market for electrical equipment.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. is now arranging its development work for the coming season. It includes the completion of the extensions to Sparta, Kent City, Bailey and Casnovia and development of the local electrical service.

KALAMAZOO, MICH.—It is reported that bids are being received for machinery for the new municipal electric-light plant, for which bonds to the amount of $150,000 have been authorized.

THREE OAKS, MICH.—Owing to the municipal electric-light plant being unable to give adequate service, the town is contemplating turning the street-lighting service over to the Indiana & Michigan El. Co., of Buchanan.

VERNON, MICH.—The village has entered into an agreement with the Consumers' Pwr. Co., of Corunna, to light the streets of the village for a period of ten years, to replace the lamps now in use with tungsten lamps and to furnish the service at the same cost as the present service.

SEDALIA, MO.—The City Lt. & Trac. Co., recently organized, has taken over the property of the Sedalia Lt. & Trac. Co. The new company is controlled by the Consolidated Cities Trac., Lt. & Pwr. Co. Extensive improvements and additions will be made to the electric generating station and the street-railway lines. H. D. Frueauff has been appointed general manager, E. W. Pfenning secretary and treasurer, and D. F. Webster superintendent.

WEBSTER GROVES, MO.—Sealed proposals will be received by J. D. Wilson, city clerk, Webster Groves, Mo., until Feb. 3 for lighting the streets, alleys, avenues and public grounds of Webster Groves with electricity for a period of 10 years, beginning Sept. 1, 1913. The proposal is to be based on a minimum of 300 60-cp, 100 200-cp and 10 350-cp Mazda or tungsten series street lamps, burning on an all-night schedule. The bidder receiving the street-lighting contract will also be granted a franchise for selling electricity for commercial purposes in Webster Groves. Bids will also be received for furnishing electricity, based on a minimum of 100,000 kw-hr. per annum, for lighting purposes, delivered to the city's substation at the city limits or other suitable location, to be distributed by the city over its own pole lines. Plans and specifications are on file in the office of the city clerk, Webster Groves, and in the office of the city engineer and the Fuller-Coult Co., Chemical Building, St. Louis, Mo. W. F. Biederman is Mayor.

GREAT FALLS, MONT.—Work has begun on the development of power at the Great Falls of the Missouri River, which it is estimated will require two years to complete and will cost about $4,000,000. Henry A. Herrick is chief engineer; Frank Scott, of Great Falls, will be engineer in charge of the local dam. It is announced that Mr. Herrick will also have charge of the construction of a dam on Clark's Fork of the Columbia River.

RENO, NEV.—The Nevada Valley Pwr. Co. has filed with the county recorder a trust deed in favor of the International Trust Co., of Denver, Col., to secure a bond issue of $3,000,000, to provide funds to build its power plants. The power site proposed to be used by the company is located on the Truckee River at the Largamarsino Bridge, about 7 miles from Reno. The company, in addition to its power sites, owns lands and a number of rights-of-way. The directors are: H. D. Danforth, of Reno, who is local agent; Edson Adams, Edward Bowes, Milton Hamilton and A. F. Tarley, all of Oakland, Cal.

CONCORD, N. H.—The Board of Aldermen has accepted the proposition of the Concord El. Co. for lighting the city and has authorized the Mayor to sign the contract for the city. Under the terms of the new contract the company is to furnish 206 tungsten lamps of 200 cp at $48.50 each per year, 197 tungsten lamps of 60 cp at $23.50 per lamp per year, and 26 40-cp tungsten lamps at $18 each per year. In addition the company will also install 85 tungsten lamps of 60 cp to replace Welsbach gas lamps, 82 tungsten lamps of 40 cp to replace a

like number of open-flame gas lamps and 17 tungsten lamps of 200 cp on Main Street, between Freight and Center Streets. Work will begin immediately on the installation of the new system.

ASBURY PARK, N. J.—The plans for the proposed ornamental lighting system for the boardwalk to be installed by the Beach Commission provides for the erection of from 85 to 90 ornamental standards, carrying five-lamp clusters, to cost from $6,000 to $8,000. From 85 to 90 100-watt Mazda and from 320 to 360 60-watt Mazda lamps will be used. The system will be maintained by wires placed in conduits under the boardwalk. W. P. Sherman is secretary of Public Grounds Commission.

JERSEY CITY, N. J.—Sealed proposals will be received by the Boulevard Commissioners of the County of Hudson, Court House, Jersey City, until Jan. 23 for furnishing the following general supplies and materials during the fiscal year ending Nov. 30, 1913: 5000 ft. No. 6 weather-proof line wire, 2000 ft. No. 6 weather-proof duplex wire, 3000 ft. ¼-in. mast arm wire, 2000 ft. No. 8 galvanized wire, 300,000 round copper-coated carbons, ½ in. by 12 in. Samples may be seen at the office of the Boulevard Commissioners, Court House, Jersey City, J. C. Sweeney is clerk.

JERSEY CITY, N. J.—Sealed proposals will be received by the Board of Street and Water Commissioners until Jan. 20, City Hall, Jersey City, for furnishing and maintaining electric arc lamps for the period ending Feb. 1, 1914, and for further period ending Feb. 1, 1918 (each proposition to be separate), in accordance with specifications for same on file in the office of clerk of board. Blank forms and specifications may be obtained at the office of the chief engineer, City Hall, Jersey City. The minimum number of lamps to be furnished and bid upon shall be 1800. Edward B. See is clerk.

CLAYTON, N. M.—We are informed that the municipal electric-light plant was not destroyed by fire, as published in the issue of Jan. 4. E. E. Kirtley is superintendent.

ARCADE, N. Y.—Bonds recently voted by the village of Arcade have been sold for $9,500. The proceeds are to be used for the purchase of a new electric generating unit for the municipal electric-light plant.

JAMESTOWN, N. Y.—The Board of Lighting Commissioners is considering the possibility of purchasing additional equipment for the municipal electric-light plant. The installation of a new turbo-generator and new boilers has been discussed and possibly there may be some extensions to the station building.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 21, for furnishing all labor and material for inspection and maintenance of electrical apparatus as follows: (a) For the boroughs of Manhattan and the Bronx; (b) the boroughs of Brooklyn and Queens; (c) the borough of Richmond. Blank forms and further information may be obtained at the office of the supervising engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

ONEIDA, N. Y.—The Board of Public Works has accepted the bid of the Adirondack El. Pwr. Co. for lighting the streets of the city. Under the new contract a large number of arc lamps will be replaced by tungsten lamps.

ROCHESTER, N. Y.—Plans are being considered for the installation of a new lighting system on Main Street between the bridge and York. It has been decided to replace the present double arc lamps with lamps similar to those on East Avenue. Work will begin on the installation of the system as soon as the ordinance is adopted and the ornamental standards secured.

CHARLOTTE, N. C.—The plans for the new lighting system for the city to be installed by the Charlotte Pwr. Co. provide for the erection of 214 posts carrying 60-watt Mazda lamps, to be maintained by underground wires.

WILSON, N. C.—The City Council is contemplating submitting the proposition to issue $160,000 in bonds, the proceeds to be used to enlarge the municipal electric-light plant and for street improvements. Benton & Moore, of Wilson, are engineers.

KENTON, OHIO.—The Hardin-Wyandotte Ltg. Co. will make improvements to its plant, including the installation of two boilers, two 500-kw alternating-current, 60-cycle generators and the erection of three substations to be located at Forest, Dunkirk and Upper Sandusky. E. W. Lothrop, of Boston, Mass., is engineer in charge. P. M. Magley is manager.

SPRINGFIELD, OHIO.—Plans for the proposed ornamental street-lighting system provide for the erection of about 150 lamp standards to be maintained by underground conduits. Contracts for the work will probably be let in the spring. The cost of the work is estimated at from $20,000 to $25,000. Fred S. Green, care of the Springfield Commercial Club, is chairman of lighting committee.

STEUBENVILLE, OHIO.—The City Council has adopted a resolution to build an electric-light plant, to cost $250,000.

COLLINSVILLE, OKLA.—The city contemplates extensions to the municipal light and water plants, involving an expenditure of about $20,000. W. F. Keller is engineer in charge.

HOOD RIVER, ORE.—The Hydro-Electric Co. has filed with the county clerk for record a mortgage for $100,000 to secure a bond issue of like amount. The company proposes to develop two water-power sites on Hood River and extend its transmission lines into The Dalles, where franchises have already been obtained. J. T. Thompson is vice-president and manager.

PORTLAND, ORE.—C. E. S. Wood, counsel for the Northwestern El. Co., states that the company will soon begin the construction of an electric line up the White Salmon River. The Northwestern El. Co. is negotiating for a site on Albina Avenue, between River and Loring Streets, on which it proposes to erect an auxiliary power station.

PORTLAND, ORE.—The city executive board has adopted a resolution authorizing the installation of 254 arc lamps to be erected in different parts of the city by the Portland Ry., Lt. & Pwr. Co., which holds the contract for street lighting.

PANAMA.—Proposals will be received at the office of the assistant purchasing officer, Isthmian Canal Commission, 24 State Street, New York, N. Y., until Jan. 22, under zone requisition 6263-A, for furnishing necessary suspended lamps, ceiling lamps, suspended fixtures, wall brackets,, etc., to equip the new Panama station building. Further information may be had upon application to Major Wendall L. Simpson, assistant purchasing officer, 24 State Street, New York, N. Y.

HARRISBURG, PA.—Application will be made to the Governor on Jan. 20 by Allison C. Harrison and William Kalbach for a charter for the Bernville Lt., Ht. & Pwr. Co. and the Penn Mills Lt., Ht. & Pwr. Co. The companies propose to operate the townships named. E. E. McCurdy is solicitor.

HARRISBURG, PA.—Final agreements have been filed at Harrisburg for the merger of the gas and electric companies in the northern end of Schuylkill County. It is proposed to combine the service of all these companies and furnish electricity from one large power and light plant at Mahanoy City, Shenandoah and surrounding townships. The population to be served will be greatly extended from Butler Township on the west to Union Township on the east. Charters for this territory were recently secured by E. F. Jarvis, Valentine Pfrom, Chester J. Hill, Walter Deitrick and Seth W. Brown. The service extends over coal tracts owned by the Reading and Lehigh Valley coal companies, and D. W. Kaercher, local attorney for the latter company, also represents the new companies. The companies merged in this district have been chartered under the name of the Schuylkill Gas & El. Co. with a capital stock of $1,000,000; those in the Hazleton district under the name of the Hazleton El. Co.; those in Clearfield and Centre Counties under the name of the State-Centre-Electric Co., of Clearfield, with a capital stock of $95,000, and those in Indiana under the name of the Clymer El. Co., of Clymer, with a capital stock of $35,000.

PHILADELPHIA, PA.—Sealed proposals will be received by the School Board of Philadelphia for furnishing electrical material for use in schoolrooms, including switches, wire, incandescent bulbs and fixtures. Further details can be obtained at the office of the superintendent, William Dick, 2242 Land Title Building, Philadelphia.

READING, PA.—The Metropolitan El. Co. has under consideration extensive plans for supplying electricity to the farming districts to operate all kinds of farming machinery.

ROYALTON, PA.—The Borough Council is considering plans for the installation of an electric-light system. It is proposed to purchase electricity from the York Haven Wtr. & Pwr. Co., to be supplied through the substation here. At present the town is using two arc lamps, which it proposes to discard and to install at least 30 tungsten incandescent lamps for street-lighting.

WHEATLAND, PA.—Under the street-lighting contract recently awarded the Shenango Valley El. Lt. Co., of Sharon, by the Borough Council, the company is to furnish fifty 100-watt, 4-amp series Mazda lamps, the construction work to be completed by Feb. 1. The company was also granted a 50-year franchise for commercial and power business. The question of extending the commercial and power lines into Wheatland will be taken up after the street-lighting system is completed. This service will be supplied from the Sharon substation. J. C. Chesnut is superintendent.

PROVIDENCE, R. I.—Bids will be asked in the near future by the engineering division of the Department of Public Works for the installation of centrifugal electrically driven and reciprocating steam pumps, with a capacity of 30,000,000 gal. daily, for the Pettaconsett pumping station.

BRISTOL, TENN.—The Electric Transmission Co. is being organized for the purpose of building a large electric plant in the coal fields near Bristol to supply electricity in this entire section. The company contemplates an ultimate expenditure of about $2,000,000. At first electricity will be supplied to the mines in this district. B. L. Dulaney and associates are interested in the project.

HALLS, TENN.—The Halls Ser. & Machinery Co. is contemplating the purchase of electrical equipment in the near future.

DALLAS, TEX.—The City Commissioners have awarded the contract for furnishing material and labor for the installation of an ornamental street-lighting system on Main and Commerce Streets to the Dallas El. Lt. & Pwr. Co. The contract for ornamental standards was awarded to the Mosher Mfg. Co., at $49.50 each.

EL PASO, TEX.—The Rio Grande Valley Trac. Co. has awarded a contract to the Stone & Webster Engineering Corpn., of Boston, Mass., for the construction of its interurban electric railway, which is to run from El Paso down the valley of the Rio Grande to Ysleta. The El Paso El. Co., which is also a subsidiary of the Stone & Webster syndicate, will make extensive improvements to its local street railway system.

Several of the lines will be extended, a 1200-volt motor-generator will be installed at the El Paso power plant and an electric transmission line erected from the plant to the city limits at Washington Park to deliver electrical power to the valley line. Five interurban cars will be purchased.

PLANO, TEX.—The Wilcox Lt. & Pwr. Co., which purchased the property of the Plano Lt. & Pwr. Co., expects to erect transmission lines to Richardson to supply electricity for lamps and motors; also power for a cotton gin within the next three months. Electrical energy will be purchased from the Texas Trac. Co. C. W. Potts is manager of the Wilcox Lt. & Pwr. Co.

SAN SABA, TEX.—The San Saba Ice & Lt. Co. writes us that it does not contemplate the installation of a new plant, as published in the issue of Jan. 4. The City Council recently granted the company an extension of 50 years on its franchise. F. B. Hall is manager.

ALEXANDRIA, VA.—A committee has been appointed by the Alexandria Court House Citizens' Association to ask the County Supervisors to have the plans for installing lamps and making sidewalks from the court house along the Ballston Road to Rosslyn carried out. It was also directed that C. T. Jesse, as a committee of one, make an investigation of the possibilities of lighting the Ballston Road through the Fort Myer Heights and Colonial subdivisions.

CENTRALIA, WASH.—The Washington-Oregon Corpn. has applied for a franchise to build an electric line along the county road from the fair grounds to Centralia.

PORT ANGELES, WASH.—The Angeles Tel. & Teleg. Co. will soon begin work on the reconstruction and enlargement of the local telephone system. C. J. Farmer is president and general manager.

PORT WASHINGTON, WASH.—Applications have been made to the City Council by the Olympia Lt. & Pwr. Co. and John H. Dalton, of Chicago, Ill., for a franchise to install and operate an electric street railway in Port Angeles. The application of John H. Dalton and associates was presented first.

SEATTLE, WASH.—The Board of Public Works has instructed City Engineer Dimock to prepare plans and specifications at once for the construction of a dam at Cedar Lake for the city water and light system, to cost about $1,500,000. Plans will be ready for estimates about March 1.

SEATTLE, WASH.—The Municipal Lighting Department expects to erect within the next 18 months one 10,000-kw steam-turbine generating station and to purchase 500 hp in boilers with all equipment, one or two steam turbo-generators having an aggregate rating of 10,000 kw with complete auxiliary equipment for same, switches and switchboard instruments for above plant. The department also expects to purchase within the next 12 months material for distribution system, amounting approximately to $100,000, largely wire and meters; also material for lighting system, to cost approximately $200,000, mostly series tungsten street lamps. J. D. Ross is superintendent.

MILWAUKEE, WIS.—The decision handed down by the Supreme Court on Jan. 8 held that the city could erect and maintain a municipal electric-light plant any time it saw fit. The court also holds that there has been no material diversion of the $500,000 in bonds raised in 1906.

CASPER, WYO.—The Natrona County El. Co. expects to purchase 120 25-ft. by 6-in. top, 30 30-ft. by 6-in. top and 20 35-ft. by 7-in. top red cedar poles within the next six months; also within the next 14 months the company expects to purchase one 150-hp oil gas producer and gas engine or fuel oil engine. J. A. Ward is general manager.

NEW WESTMINSTER, B. C., CAN.—The Canadian Western Lumber Co. announces that it will make extensive additions to its works in New Westminster, including the installation of a 1875-kw power plant, involving an expenditure of about $500,000.

VANCOUVER, B. C., CAN.—The City Council of West Vancouver has adopted a resolution calling for the construction of a municipal lighting and power plant.

VANCOUVER, B. C., CAN.—The Pacific Great Eastern Devel. Co., a subsidiary of the Pacific Great Eastern Ry. Co., has applied to the Dominion government for permission to appropriate and utilize for power purposes 2,000 second feet of water from the Cheakamus River in Howe Sound District.

WINNIPEG, MAN., CAN.—The city of Winnipeg has decided not to build a steam auxiliary power plant at present, but instead to begin work immediately on plans and construction of a two-circuit, 110,000-volt transmission line from the power plant at Point du Bois to the city, paralleling the present 60,000-volt line on the opposite side of the right-of-way. Steel towers with concrete footings will be used. The footings will be put in during 1913 and the line will be ready for service by Nov. 1, 1914. During the coming year two new hydraulic generating units, with a rating of 6500 hp each, will be installed, with switching equipment and transforming apparatus of 9000 kw, which at the generating station will consist of one 9000-kw, three-phase unit and at the receiving station of three 3000-kw, single-phase transformers. The increased load will require an extension to the McPhillips Street substation and the arc-lighting substation at May Street and the downtown station on King Street. In addition to these extensions there will also be a new substation erected in the Fort Rouge district, which will be served by a duplicate underground 13,000-volt feeder. Appropriations of $250,000 for the new hydraulic and substation equipment and of $700,000 for the new transmission line have been made. The W. E. Skinner Co., Ltd., which is promoting a central steam-heating company, has submitted a proposition to the city to supply an emergency service of 10,000 kw from low-pressure turbines. Messrs. Herdt and Kennedy are consulting engineers.

RICHMOND HILL, ONT., CAN.—Arrangements have been made whereby the Toronto & York Radial Ry. Co. will supply electricity for street and residential lighting in Richmond Hill. The lighting system, it is understood, will be installed by the town, and the company agrees to furnish energy to operate it at $26.50 per hp per year. Twenty-six 80-watt tungsten lamps will be erected on Yonge Street.

ST. MARY'S, ONT., CAN.—The Town Council has instructed Superintendent Miller to prepare plans for extensions to transmission lines of the municipal electric-light system; also to secure estimates of cost of recording instruments for keeping checks on the peak load. Thomas M. Clark is secretary.

TORONTO, ONT., CAN.—The Hydro-Electric Power Commission of Ontario, Continental Life Building, Toronto, proposes to issue about Jan. 15 specifications for various materials to be used in connection with the construction of approximately 125 miles of double-circuit, 110,000-volt transmission line and for equipment for substations for transforming 20,000 hp from the line emf to 13,200 volts. Various types of apparatus will be considered; for instance, different material for conductors and different types of steel construction for supports. Tenders for the above material will be called for in March. F. A. Gaby is chief engineer.

WALKERTON, ONT., CAN.—A by-law authorizing an extension to the electric-light service and to grant a franchise for five years was carried.

CEDAR RAPIDS, QUE., CAN.—Orders have been placed by the Cedar Rapids Mfg. & Pwr. Co. for 12 waterwheel units aggregating 120,000 hp. Nine units of 10,000 hp will be built by the I. P. Morris Co., of Philadelphia, Pa., which will also supply exciters, governors, pumps and auxiliary equipment. The remaining three 10,000-hp units will be supplied by Wellman, Seaver & Morgan Co., of Cleveland, Ohio.

MONTREAL, QUE., CAN.—The stockholders of the Cedar Rapids Pwr. Co. have voted to retire the present issue of $10,000,000 in bonds and to replace it with an issue of $15,000,000, to be issued from time to time as required for development of property.

QUEBEC, QUE., CAN.—Among the recommendations in the report submitted by the commission appointed by the Quebec Legislature to make a study of the water-powers of the Province is the regulation of the flow of water in the St. Maurice River by the construction of a dam at La Loutre (Otter) rapids which would control the flow and give a much more even supply all the year around. According to the estimates made, the dam would provide an even supply of 18,000 cu. ft. per second throughout the year at Grand-Mère, Shawinigan and La Tuquette. The cost of the work is estimated at $1,300,000

MOOSE JAW, SASK., CAN.—Sealed tenders will be received by the City Commissioners, Moose Jaw, Sask., until Feb. 10, for furnishing and installing one 1500-kw steam turbine and generator. Specifications and general conditions may be obtained upon application to J. D. Peters, electrical superintendent, Moose Jaw; the Commercial Intelligence Branch, Board of Trade, 73 Basinghall Street, or London Chamber of Commerce, London, Eng. A. W. Mayberry, L. W. Rundlett and W. F. Heal are City Commissioners.

WEYBURN, SASK., CAN.—A by-law authorizing an expenditure of $35,000 for extensions to the municipal electric-light plant has been approved.

CONCHENO, CHIHUAHUA, MEX.—The Concheno Mining Co. is installing an electric power plant at its mines at Concheno for the purpose of providing power to operate the machinery of its ore-reduction mill.

New Industrial Companies

THE ALADDIN LAMP & ELECTRIC COMPANY, of Seattle, Wash., has been incorporated with a capital stock of $12,000 by J. J. Horsfall, Robert Waddell and Norman Waterhouse, all of Seattle.

THE BALL-WASHBURNE MOTOR COMPANY, of Rochester, N. Y., has been granted a charter with a capital stock of $25,000 to manufacture motors and machinery. The incorporators are: W. H. Ball, C. H. Washburne and A. R. Ball, of Rochester.

THE CENTENNIAL ELECTRIC COMPANY, of Port Ewen, N. Y., has been incorporated by William M. Halstead, Henry Hutchinson and Guy V. Williams, 116 Broad Street, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture and deal in electrical apparatus.

THE CHELSEA OPERATING COMPANY, of New York, N. Y., has been incorporated by William A. Winter, Henry T. Franklin and William G. Lenz, 548 West Twenty-fifth Street, New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture machinery, dynamos, etc.

THE ELECTRIC COACH CORPORATION, of New York, N. Y., has been incorporated with a capital stock of $500,000 to manufacture motor vehicles. The incorporators are: John Larkin, Alexander S. Andrews and Richard J. Lynch, of New York, N. Y.

THE EMERGENCY ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 to manufacture and deal in electrical apparatus. The incorporators are: Hyman Polonsky, Arthur B. McCold and Samuel Cone.

THE ILLINOIS POST COMPANY, of Springfield, Ill., has been chartered, with a capital stock of $30,000, by T. M. Lawrence, T. J. Noblett and B. F. Bliss, of Springfield. The company proposes to manufacture concrete posts.

THE INDUSTRIAL ELECTRIC MANUFACTURING COMPANY, of Detroit, Mich., has been incorporated with a capital stock of $3,000 to deal in electrical devices. The incorporators are: F. A. Vollbrecht, George Towar and William F. Hoffman.

THE KING LIGHT COMPANY, of Peoria, Ill., has been incorporated with a capital stock of $125,000 to manufacture lighting systems. The incorporators are: E. Seltz, M. M. Lockwood and C. B. King, of Peoria.

THE RAILWAY SAFETY DEVICE COMPANY, of Marion, Ind., has been granted a charter with a capital stock of $25,000. The company proposes to manufacture and deal in derailer automatic switchlocks and other safety devices for use by electric and steam railroads. The directors are: B. B. Shively, M. C. Shroderbeck, M. L. Leapy and William Carroll.

THE RELIABLE TROLLEY RETRIEVER COMPANY, of Flint, Mich., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing electrical appliances.

THE ROLLER ELECTRIC COMPANY, of Anderson, Ind., has been incorporated with a capital stock of $10,000 to manufacture and sell electric machinery of all kinds. The directors are E. C. Toner, R. M. Roller and P. H. Branden.

THE ROYAL DISPLAY FIXTURE COMPANY, of New York, N. Y., has been incorporated by Irving O. Wildey, S. S. Ostertag and Max Rabinowitz, 45 Cedar Street, New York. The company is capitalized at $15,000 and proposes to manufacture fixtures, chandeliers, brackets, etc.

New Incorporations

EUREKA, ILL.—The Eureka Tel. Co. has been incorporated by M. F., Clinton F. and Carrie M. Melick. The company is capitalized at $2,000, and proposes to do a general telephone and electric business.

INDIANAPOLIS, IND.—The Universal Trac. Co. has been incorporated with a capital stock of $50,000 by Truman B. Funk, William D. Myers and James E. Kepperly.

ST. LOUIS, MO.—The Missouri Pwr. & Service Co. has been granted a charter with a capital stock of $2,000 for the purpose of acquiring, building and operating plants for generating power, light, heat, etc. The incorporators are: S. D. Cable, John F. Ryan and William E. Minor.

CINCINNATI, OHIO.—The Terminal Construction Co. has been incorporated with a capital stock of $6,000,000 for the purpose of constructing railroad terminals, electric-light and power plants, etc. The incorporators are: F. B. Enslow, R. M. Baker, J. William Hogan, Jr., N. H. Richardson and W. R. Fulton.

BROKEN BOW, OKLA.—The Broken Bow Lt. & Pwr. Co. has been granted a charter with a capital stock of $5,000 by H. M. Kirkpatrick, C. E. Baxter and A. E. Hart, of Idabel, and others.

PORTLAND, ORE.—The Middle West Gas & El. Co. has been incorporated with a capital stock of $5,000,000 by Albert A. Jones, T. L. Croteau, Albert A. Richards, A. B. Farnham, Clarence G. Trott, J. R. Griffin and C. L. Doane, all of Portland.

HARRISBURG, PA.—Charters have been granted by the State Department for the following companies: The Arcadia Lt., Ht. & Pwr. Co., of Montgomery Township; Burnside Lt., Ht. & Pwr. Co., of Burnside Borough; Harvey Lt., Ht. & Pwr. Co., of Burnship Township, and Smithport Lt., Ht. & Pwr. Co., of Banks Township. Each company is capitalized at $5,000, and the incorporators are L. D. Gardner, W. H. McQuilken and S. M. Houston, all of Glen Campbell. The main offices of the companies will be located at Glen Compbell.

HARRISBURG, PA.—Charters have been granted by the State Department to nine electric companies to operate in Northampton County and vicinity, with main offices in Nazareth, as follows: Huron, Seminole, Tecumseh, Iroquois, Secaucus, Seneca, Powhatan, Onondaga and Mohican electric companies. Charters have also been granted to the Williams Township El. Co., of Philadelphia, to operate in Northampton Township; to the Little Lehigh El. Co., of Philadelphia, to operate in Longswamp Township, and to the Muncy Creek and Clinton Township El. Cos., of Montgomery, to operate in Lycoming County. Each company is capitalized at $5,000.

PITTSBURGH, PA.—The Yough Hydro-Electric Co. has been incorporated with a capital stock of $5,000 by U. W. Tinker, of Pittsburgh; L. C. Lamb, of Knoxville, and G. T. McConnell, of Millvale.

WILKES-BARRE, PA.—The Tioga El. Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of $5,000. Edward A. Sweeney, 63 South Washington Street, Wilkes-Barre, is interested in the project.

NASHVILLE, TENN.—The Nashville Trac. Co. has been incorporated by Walter O. Parmer, of Nashville; Russell A. Alger, Henry Ledyard, George N. Hendrie and W. Hewie Muir, of Detroit, Mich. The company is capitalized at $500,000 and proposes to build street railways and interurban lines. T. M. Steger, of Nashville, is counsel for the company.

Trade Publications

PULLEYS.—An advance bulletin No. 1A, on the Keystone split steel pulleys bears the imprint of Patterson, Gottfried & Hunter, 215 Centre Street, New York, who handle this apparatus for the Keystone Pulley Company, Oneida, N. Y.

GLASSWARE.—The Holophane Works of the General Electric Company has recently issued a bulletin entitled "1913 Suggestions in Illuminating Glassware." Some seventy-five additions to the Fostoria lines of artistic glassware are given.

FANS.—The Emerson Electric Manufacturing Company, 2024 Washington Avenue, St. Louis, Mo., has issued its 1913 catalog on Emerson fan motors for alternating and direct current. The catalog shows many styles of desk and ceiling fans, as well as column fans and ventilators of different types.

ALUMINUM FACTS AND FIGURES.—The British Aluminum Company, Limited, 109 Queen Victoria Street, London, E. C., England, has distributed an attractive little pocket book of thirty-two pages, in leather binding, briefly describing the properties of aluminum rods, wire, bar and strip, sheets, strains, tubes and sections.

WOOD PIPE.—An attractive, well-illustrated ninety-four-page catalog being sent out by the Washington Pipe & Foundry Company, Tacoma, Wash., tells the story of its wooden-stave pipe, its value, usefulness and durability. Tables of capacities and velocities, showing the flow of water through wooden-stave pipe, are included.

TWIST DRILL COMPANY'S CALENDAR.—The Cleveland Twist Drill Company, Cleveland, Ohio, is sending out an attractive calendar 18 in. long by 11 in. wide. The upper half of each month's dates contains an advertising talk on the various manufactures of this company. The last four pages are devoted to tables and shop information.

METER AND TRANSFORMERS.—A broadsheet which illustrates "Duncan Products" (meters and transformers), to be tacked up on a wall, has been issued by the Duncan Electric Manufacturing Company of Lafayette, Ind. The sheet contains thirty-one pictures. The company also calls attention to the cupped diamond bearing and other features of its Model R meter for switchboard service.

WIRING SPECIALTIES.—The 1913 catalog of Paiste Pipe Taplets has been issued by the H. T. Paiste Company, Philadelphia, Pa. These taplets are a series of standard iron fittings which are used in connection with wiring in iron conduit and which provide convenient openings in such work for lamp outlets, for branches or for pulling in the wires. Bulletin No. 85, issued by this company, deals with the new Paiste interchangeable socket.

"THE HOUSE ELECTRICAL."—In line with the newer note in publicity methods—that of educating the consumer—the Pettingell-Andrews Company, Boston, Mass., has recently brought out a very creditable book entitled "The House Electrical," with a sub-title "Being a Brief Description of the Ideal Home and How to Plan and Equip It." Its author is Mr. Carroll Westall, manager of publicity for the Pettingell-Andrews Company. The book is 6 in. by 9 in., is well printed, beautifully illustrated, and its contents are thoroughly readable. It is bound in heavy boards and has an attractive front cover.

Business Notes

THE ROYAL ELECTRIC COMPANY has moved its Philadelphia office and repair shop from 30 South Sixteenth Street to 217 North Thirteenth Street.

THE GENERAL PIPE, BENDING & ELECTRIC COMPANY, recently incorporated for manufacturing piping materials, including bends, welded headers, Van Stone joints, valves, fittings and flanges, has established headquarters at 3020 Liberty Street, Pittsburgh, Pa. The personnel of the company includes Mr. James W. Prenter, formerly with the Best Manufacturing Company, who will act as general manager of sales; Mr. W. L. James and Mr. Walter C. McMinn, both of whom were also formerly associated with the Best company, Mr. James as erecting engineer and Mr. McMinn as shop superintendent.

THE STANDARD UNDERGROUND CABLE COMPANY OF CANADA, LTD., has established new branch offices at Montreal, Que., and Winnipeg, Man. The Montreal office, which will handle the Quebec and eastern Ontario business, is in charge of Mr. R. G. Harris, formerly with the general offices of the Standard Underground Cable Company at Pittsburgh, Pa., but more recently with the New York sales office of that company. The Winnipeg office will handle Western business, including a portion of the Province of Ontario lying west of Fort William. Mr. B. S. Stewart has charge of this office. Mr. Stewart has been for some time in the Chicago office. The general office of the Canadian company at Hamilton, Ont., will handle all business from central and northern Ontario. Mr. W. H. Marsh, sales manager and secretary of the company, has direct charge of this office as well as general supervision of the various branch offices. British Columbia, Alaska and the Yukon territory will be handled by the Seattle (Wash.) office of the company. Business from the Eastern Maritime Provinces will be handled by the Boston (Mass.) office. This is a temporary arrangement to secure prompt service for customers in those districts until the volume of business justifies establishing separate offices.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 7, 1913

1,049,333. PRIMARY BATTERY; Edward C. Brice, Mansfield, Ark. App. filed April 24, 1912. Carbon-cup electrode with porous cup for electrolyte.

1,049,347. PRIMARY BATTERY; George S. Engle, Providence, R. I. App. filed April 10, 1909. Partitioned zinc-cup electrode.

1,049,354. JEWEL MOUNTING; William Godber, South Orange, N. J. App. filed March 4, 1907. Upper and lower jewels bear on steel ball.

1,049,359. ELECTRIC TOASTER; Frank Erne Hewitt, Toronto, Canada. App. filed Feb. 24, 1912. Vertical toaster has pivoted bread holder.

1,049,362. FUSE HOUSING; Duncan C. Hooker, Farmington, Conn. App. filed April 2, 1912. Housing includes insulator for supporting fuse.

1,049,365. MERCURY METER; Dugald C. Jackson, Boston, Mass. App. filed Aug. 5, 1907. Transformer has adjustable leakage gap.

1,049,366. PROTECTING DEVICE FOR ELECTRIC CIRCUITS; Ray P. Jackson, Edgewood Park, Pa. App. filed March 13, 1911. Fusible material in electrodes melts and short-circuits gaps.

1,049,367. SYSTEM OF ELECTRIC-MOTOR CONTROL; Henry D. James, Pittsburgh, Pa. App. filed April 10, 1908. Starting resistance is controlled by weakened core member.

1,049,370. SAFETY FUSE; Louis Kovacs, Chicago, Ill. App. filed Oct. 30, 1911. Plug lengths proportional to critical current strength.

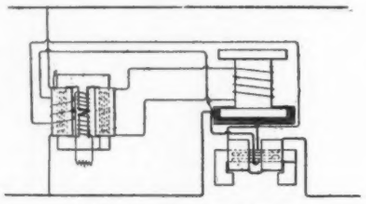
1,049,371. CUT-OUT SWITCH; Louis Kovacs, Chicago, Ill. App. filed Oct. 30, 1911. Fuse cartridge forms switch blade.

1,049,375. JUNCTION BOX FOR ELECTRICAL CONDUITS; Ernest R. Le Manquais, Fairoaks, Pa. App. filed April 26, 1911. Conduits telescope into box.

1,049,377. SYSTEM OF ELECTRIC-MOTOR CONTROL; Harry A. Lewis, Norristown, Pa. App. filed May 22, 1911. Movable finger engages adjustable drum contacts.

1,049,403. METER SWITCH; Maurice C. Rypinski, Pittsburgh, Pa. App. filed Jan. 10, 1908. Multiple-contact switch with preventive adjustments.

1,049,404. ELECTRICAL TERMINAL; Yasudiro Sakai, East Pittsburgh, Pa. App. filed Jan. 7, 1911. Insulating bushing with clamping casing.



1,049,365.—Mercury Meter.

1,049,405. INSULATOR; Ferdinand Schaub, Jersey City, N. J. App. filed July 9, 1908. Two-part knob with straight and annular grooves.

1,049,415. ELECTRICAL OPERATING DEVICE; Richard Van R. Sill, Newark, N. J. App. filed March 12, 1909. Rudder steering head controlled by sectionally wound motor.

1,049,4o0. CONTROLLER FOR ELECTRIC MOTORS; John Desmond, Chicago, Ill. App. filed Dec. 13, 1909. Adjustable contact arms.

1,049,484. ELECTRIC-CURRENT REGULATOR; William G. Housekeeper, Philadelphia, Pa. App. filed Feb. 21, 1911. Combination of series transformers of different ratios.

1,049,488. ELECTRICAL HEATING DEVICE; George A. Hughes and Trevor M. Caven, Chicago, Ill. App. filed June 11, 1910. Interchangeable connection of resistors.

1,049,499. RECEIVER; Oscar M. Leich, Genoa, Ill. App. filed March 15, 1910. Construction.

1,049,506. ALTERNATING-CURRENT INDUCTION MOTOR; Burton McCollum, Washington, D. C. App. filed March 18, 1912. Secondary contains cobalt resistors.

1,049,516. ELECTRICAL THERMOSTAT; Max Nemmert and George Schnabel, Hamilton, Ontario, Canada. App. filed Nov. 24, 1911. Dumb-bell glass tube containing mercury.

1,049,517. ELECTRIC COOKER; Will Nichols and Charles V. Uzzell, Denver, Col. App. filed Feb. 19, 1912. Fireless cooker with double air space.

1,049,522. ELECTRIC GAS LIGHTER; John Y. Parke, Philadelphia, Pa. App. filed April 6, 1912. Mechanism for producing spark.

1,049,526. DESK TELEPHONE APPARATUS; Niels Pedersen, Genoa, Ill. App. filed June 4, 1909. Switch hook with base contacts.

1,049,537. SELECTOR; Harry O. Rugh, Sandwich, Ill. App. filed Feb. 15, 1910. Notched contact wheel actuated by magnets.

1,049,558. BLOCK-SIGNAL AND TRAIN-CONTROL SYSTEM; Jasper Blackburn, Kirkwood, Mo. App. filed Sept. 21, 1908. Motor moves semaphore to non-signaling position.

1,049,562. LAMP SOCKET AND SWITCH DEVICE; Charles G. Burton, Peru, Ind. App. filed Aug. 7, 1911. Switch operated by rotating lamp and shade.

1,049,568. CHRONOMETER-CONTROLLED SIGNALING DEVICE FOR TELEPHONE-EXCHANGE SYSTEMS; Irving D. Fellows, Syracuse, N. Y. App. filed Feb. 25, 1911. Branch circuit including clock-setting mechanism.

1,049,576. TROLLEY SUPPORT; William Hadden, Crafton, Pa. App. filed March 14, 1911. Wheel mounted on bow-spring harp.

1,409,586. AUTOMATIC FIRE ALARM; Frank Koup, Syracuse, N. Y. App. filed June 19, 1912. Fusible contact-closing device.

1,049,624. MEANS FOR JOINING ELECTRODES; Edouard Viertel, Treptow, near Berlin, and Hermann Viertel, Lichtenberg, near Berlin, Germany. App. filed March 21, 1912. Threaded-nipple internal connection.

1,049,636. ELECTRIC-CIRCUIT CONTROLLER; Harry M. Abernethy, Cleveland, Ohio. App. filed May 25, 1908. Drum contact strips held by dovetailing.

1,049,657. TROLLEY-POLE CLAMP; Leslie G. Bowen, Kansas City, Mo. App. filed June 2, 1911. Clamp socket with locking jaws.

1,049,686. AUTOMATIC SWITCH MECHANISM FOR ELECTRIC LOCOMOTIVES; Robert R. Dunlop, Columbus, Ohio. App. filed July 6, 1911. Interlocking circuits for multiple-voltage trolley.

1,049,687. FLAME ARC LAMP; Henry G. Dyer, Collingswood, N. J. App. filed Jan. 12, 1912. Lower electrode is hollow and connects with regenerative duct.

1,049,703. INDUCTION MOTOR; Alexander M. Gray, Milwaukee, Wis. App. filed Feb. 28, 1910. Centrifugal means for connecting short-circuit ring.

1,049,708. AUTOMATIC ELECTRIC CUT-OUT; Josef Henrik Hallberg, New York, N. Y. App. filed July 27, 1911. Equivalent resistance automatically replaces burned-out lamp.

1,049,750. ELECTRIC HEATING STOVE; Albert E. Mastin, Sacramento, Cal. App. filed Feb. 19, 1912. Electric heater elements in lower compartments.

1,049,759. ELECTROTHERAPEUTIC APPLIANCE; William B. Oliver, Collingswood, N. J. App. filed July 8, 1908. Massage device with contact rollers.

1,049,771. CONDUIT FOR ELECTRICAL CONDUCTORS; Frank D. Saylor, Pittsburgh, Pa. App. filed Feb. 26, 1910. Armoring tube with spiral strips filled with plastic material.

1,049,775. APPARATUS FOR PRODUCING ELECTRICAL DISCHARGES; Russell Spaulding, Chicago, Ill. App. filed April 28, 1910; renewed Sept. 19, 1912. High-tension electrodes and motor blower.

1,049,786. INCANDESCENT LAMP; Ezechiel Weintraub, Lynn, Mass. App. filed Oct. 2, 1908. Combination mercury-vapor and incandescent lamp.

1,049,920. ELECTRIC METAL-WORKING APPARATUS; Adolph F. Rietzel, Westerly, R. I. App. filed July 10, 1909. Arrangement of contact clamps between heavy bus conductors.

1,049,957. FRICTION CLUTCH; Alonzo W. Whitcomb, Worcester, Mass. App. filed June 2, 1911. Electromagnet expands beveled friction wheels.

1,049,961. BATTERY; Robert C. Wood, New York, N. Y. App. filed May 10, 1912. Apertured pan with oxide forms negative element.

1,049,962. SYSTEM OF ELECTRICAL SUPPLY; William C. Woodland, Warren, Ohio. App. filed Dec. 6, 1911. Primary and secondary reactances in transformer circuits.

1,049,975. ELECTRIC SWITCH; Frederic Barr, New York, N. Y. App. filed Feb. 18, 1911. Receptacle switch with contact segments.

1,049,976. ELECTRIC SWITCH; Frederic Barr, New York, N. Y. App. filed March 27, 1911. Switch lever operates through curved slot in shell.

1,049,977. ELECTRIC SWITCH; Frederic Barr, New York, N. Y. App. filed July 1, 1912. Cam and spring-arm contact mechanism.

1,049,978. ELECTRIC SWITCH; Frederic Barr, New York, N. Y. App. filed July 12, 1912. Pull switch for wall use.

1,049,979. ELECTRIC FURNACE MEMBER AND PROCESS OF MAKING IT; Frederick M. Becket, Niagara Falls, N. Y. App. filed Oct. 12, 1911. Carbon electrode coated with ferro-tungsten.

1,050,000. TROLLEY-CONTACT SIGNAL OR SWITCH SYSTEM; Troy Cope, New Waterford, Ohio. App. filed Oct. 18, 1910. Trolley side-contact control relays.

1,050,002. ELECTRIC IGNITING DEVICE FOR EXPLOSIVE ENGINES; Edward P. Cowles, Sparta, Mich. App. filed May 12, 1902. Magneto with field built into flywheel.

1,050,004. IMPLEMENT FOR INSTALLING AND REPAIRING ELECTRIC CONDUCTORS; Jeremiah Cronin, Wapakoneta, Ohio. App. filed May 13, 1912. Insulator socket device for handling live conductors.

1,050,019. ELECTRODE; Joseph L. R. Hayden, Schenectady, N. Y. Original application filed July 9, 1910; divided and this application filed May 1, 1912. Calcium titano-fluoride is light-giving element.

1,050,020. ELECTRIC-LAMP-SUPPORTING MEANS; Reinhold Herman, Crafton, Pa. Original application filed Jan. 8, 1909; divided and this application filed July 27, 1909. Conductors retrieved by insulated reel.

1,050,021. ELECTRIC SWITCH; Edward M. Hewlett and Charles C. Badeau, Schenectady, N. Y. App. filed Nov. 12, 1900. Pull-rod mechanism for operating oil switch.

1,050,068. LAMP-CORD ADJUSTER; Frederick C. Mezger, Gatun, Canal Zone. App. filed May 13, 1912. Double reels with friction mounting.

1,050,072. ARC LAMP; Waldemar Ruhling, Berlin, Germany. App. filed May 11, 1911. Insulating flux renders slag volatile.

1,050,081. LINE-DROP COMPENSATOR; John Pearson, Somerset, Wis. App. filed Oct. 10, 1907. Phase transformer has rotatable adjustment.

1,050,082. METHOD OF LINE-DROP COMPENSATION; John Pearson, Somerset, Wis. App. filed July 22, 1910. Voltage and current circuits combined to produce regulating circuit.

1,050,085. ELECTRICALLY DRIVEN MACHINE FOR TILLING THE GROUND; Wilhelm Wortman, Mayence, Germany. App. filed July 18, 1912. Gathering reel for cable and movable tool frame.